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PROGRESS IN THE SCIENCE OF GAS MAKING.

We do not hesitate to use the term Science of Gas Making, because the fact is becoming every day more and more prominent, that wherever the business is conducted without regard to the scientific principles involved, it is becoming more and more unsatisfactory. These are searching times. Times when every man is asking in a most serious manner "why is this thus?" Perhaps there is no outpost of household expenses that the march of retrenchment is more likely to come in contact with than that of the gas bill. It is an account rendered of the coming in and going out of an invisible yet all-pervading element in the daily comfort and safety of the whole family. The gas burner is the first sentry to challenge as one enters the house, and to see it carefully extinguished is the last duty at night. All admit that the sentinel is always on post, but nevertheless, it is no use denying the fact, that every man feels that the cost of maintaining this soldier is more than it ought to be. This may be a popular error. In many cases one forgets the amount and value of the service rendered, and really thinks he is overcharged. Sometimes neglect on the part of the consumer may have entailed an expense, which he unjustly urges the "company" should bear. But whatever the cause may be, there is one fact that may be considered as established, viz., there is a very general belief that gas bills are too high, and it becomes a very serious question as to what the companies can do to reduce them.

Let any man who doubts what the consumers are disposed to do, consult his daily reports of gas sent out, and compare them with corresponding days for the past few years. Now, loss of business cannot be considered profitable. What is to be done? The natural expedient is to reduce cost of production, and, in many cases, the discharging of a few men, and perhaps trying to get a little more out of the coal is considered sufficient effort in this direction. But this will not cure the evil. The remedy is too mild, and what is far worse, it is of the wrong character. The present excessive cost of manufacture is a brain difficulty, or a difficulty resulting from long disuse of the brain faculties. The rule of thumb has had too full a sway, and the time is coming when it must vanish, or profits will dwindle, from the fact that extravagance and want of knowledge are most often traveling companions.

The true remedy is to reduce the practice of gas making to a true scientific basis. By this we do not mean a theoretical basis, but a practical working one, founded upon correct scientific principles. In England, some of the first minds of the Kingdom are enlisted in the service of the gas makers. This is a necessity that has arisen from the fact that *Legislation* has forced down the price of gas to the minimum, and in order to save their existence science has been enlisted, not for "three months," but, "for the war," which, judging by the files of English journals which we receive, is not likely to close very soon. Every residual is made available. Every step of the process is studied and watched with the greatest care, and every true improvement quickly availed of.

Science points out the direction of the course to be sailed, and bold, strong, practical men do not hesitate to try it, thoroughly explore and examine the indicated route, and, what is of the utmost value to the profession, report the results of their search. And here is the strong point of the English companies: while showing every readiness to furnish their product as cheaply as possible, they act in harmony with each other. This is shown by the number and character of their Gas Managers' Associations. They come together, both to impart and to gain information, to instruct each other, to keep themselves "posted." This is what is needed here; more real interest in our associations; more careful study in preparing for the meetings; and a more thorough method of keeping records, each for himself, of what is actually done. It is only by comparison of results that one can know how well he is doing. Then, when one finds himself behind his fellows, he can go to work to put himself right. The best possible apparatus, a good library of the best books, *well used*, and a hearty co-operation with each other, will place the profession where it should be, and enable them to take the lead in giving gas at lower rates, instead of being obliged to follow the "cry," which is ever likely to become extreme and unreasonable, if not controlled.

CANDLE FEET.

We published a few weeks ago an article by Mr. Farmer, in which he proposed the use of a new term in gas nomenclature, viz., "Candle Feet," by which we can express the light-giving quality of any given coal. The adoption of this term would certainly tend towards unity and conformity in speaking of the properties of coal—used for illuminating purposes—and the term is easily understood by any one. It is a natural

one when we come to consider what it expresses, although at first it might seem purely arbitrary. It expresses simply the *product* of the yield in cubic *feet*, by the illuminating power of that yield, in what is commonly used as the standard, viz., *candles* of the standard kind; hence we have candle feet. There is another reason for its adoption, and that is simply conveinance in expressing concisely, what it has always taken quite a number of words to state. The value of any coal for gas making depends chiefly and foremost upon two things, viz. 1st The amount of gas, or the number of cubic feet obtained from a given unit of measure, which is usually one pound, or what amounts to the same thing, a multiple of the pound known as a ton, or 2240 lbs. 2ndly. Upon the amount of light-giving power which the gas possesses, or what is known as the candle power of the gas.

Of course there are many other items that contribute to our final judgement such as cost, purification, amount and character of coke, etc., but these are incidental. The main question as regards the coal is, how much and how good will be the gas which it gives. A single term exrsessing this, if adopted generally, would certainly be an advance in our gas language. In speaking of gas by itself as a commercial product, the main question may he the quality, but when the test of cost of manufacture comes in then the other element, namely the quantity obtained per pound, becomes a very important factor. How often we hear the remark, "small potatoes and few in a hill." The latter clause certainly adds a very important fact to the statement. Now, abolishing at once the idea that the term is abstract or arbitrary in itself, and bearing in mind its exact meaning, we would urge those of our readers who are interested in the progress of the science of gas making, to read an article in another column wherein Mr. Farmer explains exactly by examples, just how candle feet may be used to great advantage. The idea of making mixtures of coal by rule may be new to some, but it has long been practiced by others, and it is no untried theory, for the results that have been actually obtained, have fully verified the truth of the rule.

DEATH OF MR. CHAS. COLLIER OF SELMA, ALA.

Erom a private letter received a short time since, we are informed of the death of Mr. Chas. Collins. At the time of his death he was Engineer of the gas works at Selma, Ala. Many will recall him as a member of the American Gas-Light Association. He had been long engaged in the business of gas-making, and those who knew him best, and were most intimately associated with him, will feel his loss the most. Of upright and straightforward character, he commanded the respect of those about him, and in his death the profession will lose the benefit of his long experienced and good judgement, which in these timef if can ill afford.

Movable and Adjustable Dip-Pipe.*

[Communicated.]

The advantages to be derived from adjustable dip-pipes are not fully understood, and in order to illustrate this point I propose to give a few examples and figures, to show the advantages to be derived from having an apparatus so arranged that each or any of the retorts may be worked under a vacuum, if desired, or under any desired pressure.

* For illustration, see July 3d, vol. xxv, p. 20.

The principal novelty of this invention is the arrangement for raising and lowering the dip-pipe.

In the top of the upper chamber there are fixed two small dip-pipes, with about one inch bore, which run down into the liquor in cups and form seals. At the lower end of each tube there is a lug, which is cast on the outerside of an inverted cup on the movable dip-pipe.

Down the centre of each tube there are placed two wrought iron rods, which are secured at their lower ends to the said lugs on inverted cup, and at their upper ends to the arms of the wrought iron lever above.

The said lever, which is hung on the top of the bridge pipe, for the purpose of raising or lowering the movable dip-pipe, is formed with 2 arms, so as not to interfere with the removal of the stopper on top, or the cleaning out of the dip-pipe.

One of the said arms of the lever is attached to the vertical tube rod on the right of the movable dip-pipe, and the other to the other vertical tube rod on the left.

The movable dip pipe is raised or lowered by means of a long vertical rod which comes down in front of the bench. The upper end is hung to the horizontal lever above, and the lower end is slipped on and off an adjustable hook which is fixed on the hub of the mouthpiece.

By means of these adjustable hooks, the whole of the dips or seals in a retort house can be adjusted to any degree of gange. We can counteract any variation of seal, when caused by settlement of hydraulic main, or distanc from exhauster, and consequently save a large amount of gas, and also prevent a large accumulation of carbon from forming in the retorts.

This apparatus is both simple and efficient, and has *neither slide valves nor stuffing boxes* to get out of order.

As a general thing every dip-pipe in a retort-house requires a dip or seal different from the rest, because the draught is always variable. At one point the draught (of the exhauster) on retorts will be too strong, and at another too weak, consequently we want a dip-pipe which can be easily adjusted to suit the draught at every point.

The whole of the dip-pipes should be carefully examined, and adjusted once a week, and set by the gauge to that degree which suits the coal used, and candle power required.

For ordinary coals, such as Penn or Westmoreland, the pipes may be set so that an *even gauge* will be maintained in every retort in action.

For mixtures which contain a large amount of enrichers, the dip-pipes may be set so that five or more tenths *vacuum* will be maintained in every retort in action—where a 15 or 16 candle gas is required.

When the ordinary fixed dip-pipes are used, this vacuum cannot be maintained, because atmospheric air will be drawn in at all the dip-pipes which may be out or level, or which may be connected to retorts out of action.

If any of the retorts in action should become leaky, or could not be depended upon, the movdip-pipes on said retorts can be lowered immediately, and adjusted without interfering with the remainder of the retorts.

By using a large percentage of good enrichers and adjustable dip-pipes, the *yields* may be increased enormously, and the quality of the gas still maintained at the standard.

I will now give a few examples to show the great value of enrichers, and also the use of the *formula for "Candle feet,"* in calculating gas or coal mixtures.

Ordinary Penn coal, according to Mr. Lamson's tests, will produce 5·14 cubic feet per lb., of 13·41 candle gas, when the retorts are run under one-quarter inch pressure, and 6·38 cubic feet per lb. of 10·91 candle gas, when retorts are run under a half inch vacuum.

Suppose an enricher, **A**, will produce 4·464 cubic feet per pound, or 10,000 cubic feet per gross ton, of 36 candle gas; and an enricher, B, will produce 4·464 cubic feet per pound, of 56 candle gas.

To find what percentage of each must be used to produce a 15 candle gas, we must first find the value of each in *Candle feet*, as in the following table:

Coal.	Yield.		Candle pr.		Candle ft.
Penn.	5·140	×	13·41	=	68·92
"	6·380	×	10·91	=	69·60
A.	4·464	×	36·00	=	160·70
B.	4·464	×	56·00	=	249·98
Mix'r.	5·140	×	15·00	=	77·10
"	6·380	×	15·00	=	95·70

Example 1.—A mixture of Penn. coal, and enricher A, is required, that will yield 5·14 cubic feet per pound of 15 candle gas, when the retorts are run under one-quarter inch pressure. What percentage of each will be required to produce these results?

From the preceding table we find that this mixture should yield 77·10 candle feet; that enricher A should yield 160·70 candle feet, and that the Penn. coal should yield 68·92 candle feet.

Rule.—From the candle feet of enricher, subtract the candle feet of mixture, and multiply the remainder by 100, for a dividend.

From the candle feet of enricher, subtract the candle feet of the ordinary coal for a divisor; the quotient obtained from the said dividend and divisor will give the percentage of the ordinary coal required, and the said percentage, subtracted from 100, will give the percentage of enricher required in the mixture, as follows:

$$\frac{(160{\cdot}70-77{\cdot}10)\times 100}{160{\cdot}70-68{\cdot}92}=91{\cdot}087 \text{ per cent. of Penn required,}$$

And 100—91·087=8·913 per cent. of enricher A, required.

PROOF.

	Percentage.		Candle ft.		Product.
Penn.	91.087	×	68·92	=	6277·71604
Enricher A.	8·913	×	160·70	=	1432·31910
	100				7710.03514
	Candle feet of mixture				77·10035

And $\frac{77{\cdot}100}{5{\cdot}14}$=15 candle power of mixture.

Consequently it will require about 91·087 per cent. of the Penn coal, and 8·913 per cent. of the enricher A, to produce 5·14 cubic feet per pound of 15 candle gas, when the retorts are run under one quarter inch pressure.

Example 2.—A mixture of Penn coal and enricher A is required, that will yield 6·38 cubic feet per pound of 15 candle gas, when the retorts are run under half-inch vacuum. What percentage of each will be required to yield these results?

By working this out in the same manner as example 1, it will require about 71·35 per cent. of the Penn coal, and 28·65 of the enricher A, to produce 6·38 cubic feet per pound of 15 candle gas when the retorts are run under half-inch vacuum.

Example 3.—A mixture of Penn coal and enricher B is required, that will yield 5·14 cubic feet per pound of 15 candle gas, when the retorts are run under one-quarter inch pressure. What

percentage of each will be required to produce these results?

Ans. The mixture will require 95·48 per cent. of the Penn coal, and 4·52 per cent of the enricher B, to produce 5·14 cubic feet per pound of 15 candle gas, when the retorts are run under one-quarter inch pressure.

Example 4.—A mixture of Penn coal and enricher B is required, that will yield 6·38 cubic feet per pound of 15 candle gas, when the retorts are run under half-inch vacuum. What percentage of each will be required to produce these results?

Ans. The mixture will require 85·53 per cent. of the Penn coal, and 14·47 per cent. of the enricher B, to yield 6·38 cubic feet per pound of 15 candle gas, when the retorts are run under half-inch vacuum.

William Farmer, 111 Broadway, N. Y.

A Curious Fact in Lime Purification.

[Communicated.]

A curious fact was recently observed at our works. On June 2d one sett of lime purifiers was thrown out of action, and the vessels with their contents left closed and undisturbed, until July 28th, (nearly two months) except that one of the covers was raised during a few hours one day for repairs. When the gas was diverted from these purifiers, the second vessel of the series was "foul," and the lead paper soiled readily upon application to the test-cock. Two months afterwards the same purifiers were again brought into action; but, to our surprise, the second vessel did not soil the test-paper, and continued to pass clear gas for three whole days thereafter at the rate of 400,000 cubic feet per day.

Now, the question is—how did the foul lime, already saturated with sulphuretted hydrogen recover the capacity to absorb more, while shut up in the closed box?

The only explanation which has offered itself to my mind is that the complete reaction between the hydrate of lime and sulphuretted hydrogen requires more time than is usually allowed, even with the largest area of purifier surface yet introduced; and that ordinarily the lime becomes foul long before it has absorbed its full quantum of this impurity, simply because it cannot combine with and hold it as rapidly as it is presented by the stream of gas; but when an opportunity for complete combination is afforded, as in the case above noticed, a much greater volume can be retained.

If this explanation be correct, it follows that, in order to obtain the most economical results, the purifier area should be made as large as possible within the limits of convenient working.

Another point in this connection will interest those members of the Gas Light Association who doubted whether gas would pass at all through the blocks of lime exhibited at the Washington meeting. It is this: That there was no increase of pressure in these purifiers after they were brought into action the second time, and after the lime had remained in them two months.

New Orleans, Aug. 4, 1876. T. F.

Public Education.

There has been of late some quite pointed discussion upon the advantages of technical education; some maintaining that the true education is to be found only in the "School of Experience." On this side of the question whatever the plausible theories may be that are advanced by the advocates of "self made men," there is one thing that seems to be forgotten by them, viz: they, as a class, are judged only by the successful men; for the number of unsuccessful ones cannot be known—and the high position attained by some of the former has only been the result of a deep and careful study of the works of the schoolmen.

It is not often, however, that we find men bold enough to criticise our public school system, and especially is it rare in a public official to bring the system to the test of the financial level and square.

But when, in a city of 15,000 people, the school expenses omount to $60,000 per annum, it would seem to be time to find out what there is to show it. Mr. Henry Bedlow, the recently elected Mayor of Newport, R. I., in his inaugural address, speaks as follows on the subject of public schools.—Ed.

Public Schools.

In the annual report of the School Committee—including the tenth of the superintendent of public schools, together with that of the head master of the Rogers High School—you have a detailed exposition of the condition of the different departments of these institutions. The plan of grading them has, as you are there informed, succeed as an experiment.

As to the details of our school system I cannot with propriety speak of them—for it requires a long and close as well as intelligent inquiry fairly to appreciate their excellences or defects.

No person, however, can be unimpressed by the importance of common education, especially in a free country—indeed no one can rate it too highly. The design must always call forth the enthusiasm of all lovers of their kind. The general excellence of our actual school system is also a matter of just pride. But pardon me when I suggest, as I do now, that enthusiasm for this noble cause has carried it so far, that it is now time we should pause and consider one thing, this—viz: How far education of a higher form may benefit the individual and promote the economical interests of the country? If it do neither, if a certain dissatisfaction and discontent naturally arise under a high state of education—if the majority of scholars are fitted for vocations they are not likely ever to be called to fill, while they become averse to lower but much needed sorts of labor—if these and similar things are true, then the question of money, of expense, (of very great expense indeed, in order to support these parts of a system which may be absolutely noxious, becomes a very serious question, and is daily becoming more so.

Tax us freely for *fit* education—we like it; but we begrudge every penny wasted on an education which is *unfit*. Americans cannot all become lords and ladies; there must be somebody below as well as somebody above, and unskilled manual labor cannot forever be devolved upon that Helot—the immigrant.

To this subject then I respectfully call your unprejudiced attention, I say unprejudiced—for while nothing is more fortunate than the rising popularity of public education, it will be very unfortunate indeed, if that popularity be used to prejudice and prepossess the mind against suggestions which may possibly be useful. That the gist of these remarks may not lack explicitness, I repeat—that while I do not propose to raise any issues in any aggressive form, regarding myself as simply the representative and not the leader of public opinion on this subject, I feel that a necessity exists of checking the excesses to which enthusiasts would lead the public in its too generous support of these institutions, and I am convinced that their growing expense, though not at present attracting public comment, will yet become not only an important question of the day, but that it will press itself upon the general attention until it is settled, and settled rightly, by restricting appropriations within much smaller limits.

If it require some moral courage merely to hint this measure of reform, believe me, gentlemen, it demands more to suggest to you in open antagonism to a popular enthusiasm, the importance of your taking at this time the initial step towards a less lavish expenditure of public money in behalf of these necessary, but, as at present conducted, highly expensive establishments.

The recommendation of the committee for the establishment of an industrial school, under the joint control of the city council and the school board, I advocate most heartily. Some system likewise of compulsory education seems at present to be the remedy (prophylactic in treatment) for a large percentage of idleness and consequent licentiousness.

With regard to the election of the superintendent of public schools by popular vote, I have nothing further to add to that which I have already advised respecting the offices, of city marshal, street commissioner, etc., except it be to protest more forcibly against its continuance in this connection than in the others.

When the tenure of office depends upon the propitiation of a political party on the one hand and of a committee on the other, this effort to serve two masters results in something quite as objectionable, as the consequences of that endeavor biblically set forth. A relaxation, if not an absolute neglect of the official responsibilities of the incumbent, follows to the prejudice of the whole educational system—and his tenure of the office comes to depend on something else than the proper performance of duty or establishment of discipline. Moreover it opens a door for the entrance of those who seek the position for convenience or for some urgent necessity of a livelihood, and such are not apt to recognize any well-defined obligation affixed to their position, or, if recognizing it, see no more serious penalties attached to inefficiency than the doubtful chance of being superseded in another election.

As the whole duty of the superintendent is to carry out the rules of the school committee, or to expend the money appropriated by the city council, it would seem that he should be elected by one or the other of these bodies, and should be responsible to them. As it is, it is a double-headed system.

The schools are controlled by two authorities each practically independent of the other. The school committee may make rules, but they have no power to compel obedience from the superintendent or to prevent him from giving counter-orders. Efficiency cannot be obtained in this way. Napoleon said that "there was but one thing worse than a bad General, namely; two good Generals, of equal power." It is thus that our schools are now governed, In my opinion the electors should either cease to appoint the superintendent, or cease to appoint the school committee; it might even be preferable to have the power of appointing both superintendent and committee transferred to the city council.

Japanese Enterprise.—It is stated that a Leeds engineering firm has some work in hand of a very exceptional kind, viz., providing the plant necessary for the introduction of the iron trade into Japan. The firm alluded to is sending off for this purpose plate, rail, and guide mills, steam hammers, shears, lathes, cranes, and all other necessary appliances, of the most modern construction.—*Ironmonger.*

The Manufacture of Coal Illuminating Gas.*

By Alfred P. Trautwein, M. E.

The manufacture of gas for illuminating purposes, together with the several trades directly or indirectly connected with it, has now become one of the most important of our many great industries, involving as it does as large an amount of capital as any, and being at the same time of such vital importance to the community at large. It has, as such, recently led to the development of a particular branch of Engineering and Chemistry; and the profession of Gas Engineer and Manager, though one of the youngest of all, is not the least important. The subject, too, continually receives a great deal of attention from both scientific and practical men, and it affords indeed a most extensive and lucrative field for invention, improvement and scientific research.

It is hardly more than 60 years since gas-lighting was first successfully practiced in England; but its introduction seems to have progressed very slowly until 1845, which may well be considered the date of a new era in artificial illumination. In the short space of time which has since elapsed, most of the great improvements in gas manufacture have been achieved, and the rapidity with which it has assumed its present enormous dimensions is truly wonderful.

The difficulties, it is true, both mechanical and chemical, and particularly the latter, which all had to be overcome, must have appeared at one time almost insurmountable; but, with the aid of the Civil and the Mechanical Engineer, and above all of the Chemist, most of them have been successfully removed. Another very formidable obstacle was the existence of intense popular prejudice, aided largely by the occurrence of a series of unavoidable mishaps, by the agitation of individuals who were interested in the failure of gas-lighting, and finally by the apparent indifference, and, in many cases, even opposition on the part of the more educated classes; but this, too, had to give way in the course of time.

It is exceedingly interesting to follow up the progress which was thus gradually made, and a review of the early histoty of gas-lighting will afford us an excellent illustration of how a great invention was originated, gradually perfected and introduced, and will enable us to better appreciate the efforts and the perseverance displayed by those who made the first attempts at practical gas-lighting.

The existence and inflammability of coal gas have been well-known facts in English coal mines for more than two centuries. The first mention which we find made of it is in a paper by Thomas Shirley, which was communicated to the Royal Society in 1659, being subsequently published in the Transactions. In it he correctly attributed the gases from a "burning well" near Wigan, in Lancashire, to the extensive coal beds which underlie that locality. Soon after, the Rev. Dr. John Clayton repeated the experiments which led Shirley to the above conclusion, and he even went as far as to make gas, or, as he called it, "the spirit of coal," from the Wigan coal. The date of his experiments was the year 1691, and in a letter to the famous Robert Boyle, which may be found published in the Philosophical Transactions for 1739, he detailed the results of his labors at some length. In 1726, Dr. Stephen Hales, in his work on "Vegetable Statics," described similar experiments which he had made with Newcastle coal. Clayton and Hales, therefore, were the first who subjected coal to dry distillation. In the Transactions for 1733, we find a paper by Sir Jas. Lowther, on the "inflammable air" from one of his mines near Whitehaven. About the middle of last century, Dr. Watson, afterwards Bishop of Llandaff, and so well-known for his "Chemical Essays," observed the fact that gas could be conveyed in pipes, and what is even more important, that the gas remained inflammable even after having been passed through water.

* A Graduating Thesis at the Stevens Institute of Technology.

Some time previous to this a chemist had succeeded in producing coke whose value for heating purposes was soon so generally recognized that its manufacture seems to have become quite an industry. Among others, the Earl of Dundonald took out a patent for a new process of making coke and tar; and, in 1786, he erected a number of ovens at Culross Abbey, in Scotland. The gas thus produced, being a mere bye-product, was usually allowed to escape; at night, however, it was sometimes fired by the workmen, not simply as a matter of curiosity, but for the purpose of aiding them at their work.

But, although the properties of coal gas were known to so many persons, the idea of producing it for, and applying it to, the special purposes of illumination, does not appear to have occurred to anybody until the year 1792, when William Murdoch, an engineer residing at Redruth, in Cornwall, constructed a gas apparatus with which he lighted his dwelling, offices and shops. He had already experimented upon the quantity and quality of the gas produced by distillation of coal, peat and wood, and being struck by the great quantity which was yielded particularly by cannel coal, by the brilliancy of the light and the facility of its production, he continued his researches in a very systematic manner and determined, in the first place, the cost at which the new light might be made. But the prejudice with which every great invention has to contend, did much toward preventing, him for the time being, from introducing his gas. Although he found no one to imitate him, Murdoch was not discouraged in the least, and in 1797 he erected a similar apparatus in Ayrshire. In the following year he removed to Soho, near Birmingham, and became connected with the great works of Boulton, Watt & Co. Thus far he had only produced gas for his own use: Watt alone was unprejudiced enough to give the invention a fair trial on a large scale, and Murdoch accordingly built a very successful gas works for the Soho Foundry, finding, meanwhile, sufficient time to continue his experiments upon the different coals and the various forms of burners which he had invented.

It was stated above that Murdoch had no imitators in England. In France, however, Lebon, in 1799, experimented with wood gas; in 1801, he successfully lighted his dwelling with it, but in attempting to introduce his invention he met with even less success than did Murdoch during the first few years. Lebon has often been styled the "inventor of gas-lighting"; there is no doubt, however, that he was fully anticipated by Murdoch, who unquestionably has the honor of having been the first to conceive the idea of applying, and who, moreover, did actually apply gas for illuminating purposes—and he is now generally considered the father of practical gas-lighting.

Murdoch's invention excited little or no attention until 1802, when, on the occasion of the Peace of Amiens, the front of the great Soho Engine Works was brilliantly illuminated; and this being the first public display all Birmingham turned out to see the new light.

In 1805, Boulton, Watt & Co., under Murdoch's directions, lighted with gas the cotton mill of Messrs. Phillips & Lee near Manchester, then the largest in the kingdom. The application here was eminently successful, and in a paper read before the Royal Society in 1808, Murdoch gave a detailed account, showing at the same time the economy in this over all other methods of artificial illumination, and for which he was awarded the gold medal of the Society. It also appears from this paper that at the time of his first experiments he had no knowledge of the papers of Shirley and Clayton.

A fortnight before Murdoch lighted the Manchester mill, one of his pupils at Soho, Samuel Clegg, who subsequently became so well-known for his many inventions and improvements in gas manufacture, had, it appears, succeeded in lighting a mill at Sowerby Bridge near Halifax.

Soon after several other mills adopted the new light and, among others, a button factory is said to have largely used it for soldering; but although its use was thus spreading in the manufacturing towns, very little or no progress may be recorded in the direction of introducing gas-lighting into London. This, to some extent, may be accounted for by the fact that no means then existed for purifying the gas, and until such could be found, there was little or no hope of success.

The idea of a new method of lighting was taken up with great energy by a German named Winsor, who, though nothing like as earnest and honest as Murdoch, knew infinitely better how to treat the public in such matters. Winsor, who appears to have been deficient both in chemical knowledge and mechanical skill, but a man of wonderful perseverance, obtained in 1803 the first English patent for gas making. In the same year he delivered a course of lectures at the Lyceum in London, experimenting publicly with the gas, but keeping the mode of making it secret. In 1804 he issued the prospectus of a "National Heat and Light Company." That he largely overrated the powers of the new invention becomes evident when we think of the enormous dividends which he promised to subscribers; whether or not this was done intentionally would be difficult to decide, but it appears to have been the only course which could then be taken. A subscription, it is said of £30,000, was soon raised but equally soon expended in fruitless experiments. Winsor, however, still continued to use every means of creating a popular interest in the new light, and then, too, the success of Murdoch and Clegg drew public attention to the subject. Money again came in from all sides, and the experiments which were then instituted seem to have had at least one good result, viz.:—the introduction of lime purification due, it is said, to the efforts of Dr. Henry and Mr. Clegg. In 1809 Winsor obtained permission to remove a number of oil lamps in Pall Mall and to substitute gas. An application for a charter was now made, but with no success. Although it appears that the whole enterprise was not of a kind to meet with the approval of the public at large, and although the modes of making and purifying the gas were very crude and deficient, while scientists, engineers, and, for very obvious reasons, Murdoch himself, opposed the scheme, even then Winsor continued in his undertaking. The following extract from Dr. John Webster's "Elements of Chemistry" (published in 1711) will serve to illustrate the opinion which scientific men then entertained of the subject of gas-lighting. "It is true that much of the offensive smell may be taken away from the gas by passing it through lime water; but the whole process is attended with much trouble, inconvenience, and expense; and notwithstanding the value of the coke and tar, the products of this operation, the generality of scientific persons seem to view it more as a matter of amusement than as likely to be productive of public or private advantages."

The charter was finally granted; in December, 1813, Westminster Bridge, and in the following year many of the streets of London were lighted by the Winsor, or, as it was then known, "The Chartered Gas-light and Coke Co." The operations of the company were now on a larger scale; but to the difficulties which had hitherto been mainly chemical, were now added the equally important ones of a mechanical nature. In 1813 the management of the works was entrusted to Mr. Clegg, but even under his able direction the company could not declare any dividends until three or four years later. The charter was renewed and extended in 1816, and seven years later the company had 3 stations, 122 miles of mains, and used about 21,000 chaldrons of coal per annum.

Soon after Paris adopted the use of gas, due mainly to the exertions of indefatigable Winsor; the example of the great Metropolis was but slowly followed, and if gas-works were at all built on the Continent, it was almost invariably done by English capitalists. Even now this state of things exists to some extent, and not few of the French and German cities are supplied with gas from works built and operated by English capital and engineers.

The history of the development of gas-lighting in the United States, on the other hand, is much brighter. Its great importance was pointed out at a very early period; in fact not very long after its success had been established in England, and the practical and enterprising mind of Americans rendered it less difficult here than elsewhere to make gas-lighting general. In the "Columbian Phenix," published in Providence, Rhode Island, November 13th, 1813, appeared an advertisement of an "Improved Gas Apparatus for lighting Manufactories, Mines, Theatres, Light-Houses and other Buildings, with Hydrogen Gas or inflammable air produced from Pit Coal." It was the invention of Mr. David Melville, of Newport, Rhode Island; it originated in 1805-6, was improved in 1810-12, and was finally patented on March 18, 1813. It was in successful use in Mr. Melville's residence, in a cotton mill at Watertown, Mass., in the Wenscutt and Arkwright mills, near Providence, and, in 1817, in the Beaver Tail light house. (For a more complete account—see AMERICAN GAS-LIGHT JOURNAL, Feb. 16th and March 2d, 1876.

The manufacture of gas for lighting cities was first attempted in Baltimore, in 1817, but, until 1821, the success does not appear to have been great. In the course of the next year Boston adopted gas, New York following in 1825 with the formation of the New York Gas-Light Company. In the same year the then little towns of Bristol and Brooklyn began to use gas. In 1830 the Manhattan Company of New York, now the most important concern of its kind in this country, was started. New Orleans used gas as early as 1835, as also did Pittsburgh, and in 1844 Cincinnati and Philadelphia began to enjoy the advantages of a system of gas-lighting.

The introduction of gas now progessed very rapidly, and within 10 years there was hardly a city of any importance which had not already adopted it. At present gas-lighting has become so general that many towns of 1000 inhabitants or even less, and many private establishments can boast of having a gas-works.

A few statistics in this connection may be of interest, while they will certainly serve to illustrate the enormous dimensions which gas manufacture has recently assumed. In the first place the 800 or more gas companies in the United States represent a capital of more than $70,000,000, fully one-third of which is invested in the works in this immediate vicinity. In London, the 13 companies operating 19 works, employed in 1865 a capital of £5,500,000; 8,000 million cubic feet of gas were sent out during the year, to produce which 850,000 tons of coal were necessary. Since then not only have many of these works been greatly enlarged, but several new ones have been erected, among others the well-known works of the Chartered Company at Beckton. The maximum daily make of this company during the coming winter is expected to be 21 million feet, and that of the Imperial Company about 25 million feet.

In Paris, in 1875, the ten stations of the gas-light company sent out 6211 million cubic feet, to distribute which 1000 miles of main were used.

The works in New York and its immediate vicinity certainly do not send out less than 23 millions of feet on the night of the 24th of December, and in Philadelphia the City Gas Trust reports in 1875 the amount of gas made at its four stations to be 1,900 million feet—the maximum in twenty-four hours being nine millions of feet.

[To be continued.]

British Association of Gas Managers.

WEDNESDAY, June 14.

[From London "Journal of Gas-Lighting."]

At the opening of the sitting this morning, Mr. C. Woodall, of London, read the following paper on

SUNDAY LABOR IN GAS WORKS.

In willingly acceding to the request of our president and other of my friends, to bring the subject of unnecessary Sunday labor again under your notice, I am conscious of two principal difficulties—first, the subject has already been discussed at a meeting of the Association; and secondly, I have an impression that some, though possibly very few, members regard the question as one outside our proper sphere, as an assembly of practical men.

This last objection will, I am sure, vanish upon consideration. We give earnest and ready attention to any proposition for the improvement of portions of our machinery and apparatus; we will not withhold it from the welfare of those without whom machinery and apparatus can accomplish no profitable work. Again, if the profits of a gas company are made or lost as the work in the retort-house is well or ill done, and few will dispute the proposition, it is of importance to consider whether the course advocated is such a one as will, by injury to apparatus or otherwise, peril the chances of success.

As to the other point, I think the circumstances attending our previous discussion of the question both justify and require that it be further noticed. It is now six years ago that Mr. Morton read a short paper on Sunday labor in this room. The proposition that such labor was to a large extent unnecessary, and therefore should be diminished, came as a novel idea to the majority of the audience who listened to it. Further, the number of those who had taken any practical step in the direction indicated was so small that a discussion of the proposal, with any degree of thoroughness, was impossible. It will be in the recollection of the members that, after some most cordial remarks, the meeting requested a committee to report upon the matter. That committee issued a series of questions to the managers of all the works represented in our Association, intended to ascertain—first, whether the sympathy of managers generally was with those who desired to diminish Sunday work; and secondly, where that sympathy existed, how far it had been possible to give practical effect to it. The replies to those queries showed a degree of interest in the matter that was worthily responded to by the report presented by the committee. Many had already done much in the desired direction; others would, but feared to do harm to their retorts. It was to the latter, and to those who, whether avowing it or not, yet felt that the harm done would outweigh the advantages, that the committee specially addressed their report, setting forth the means by which, in their opinion, the greatest amount of labor could be dispensed with, and a minimum of risk incurred.

Having made this short statement of what had been done at the time of the committee's report (1871), permit me to notice some incidents of the subsequent history of the question, and then to refer to the difficulties and objections that have been raised, and attempt to answer them.

It was most unfortunate that in the year following the committee's report the matter of Sunday labor and its reduction was pressed into the service of the stupid and mischievous men who advised the strike of stokers in London; unfortunate, because it was so natural that there should be a decided repugnance, on the part of managers, favorably to consider any matter thrust upon them in such offensive guise. There was also a feeling on the part of some (the engineer of one company wrote me to that effect), that the action already taken had suggested discontent to the men. Now, it is worthy of note, that from the men who used this question as a cover for their evil course, we heard much more about double pay for Sunday, than about relief from work, and the importation of Sunday into the quarrel did not alter the fact that, so far as the movement had a motive, it was entirely one of wages. Further, some managers found when, as was generally conceded about the time I refer to, increased pay was given for the Sunday work, that the men preferred to stay in the retort-house and draw the large wages, rather than take the relief from work. Although such has been the experience of some, I have no hesitation in saying that, with a very large section of the men, there has been throughout a thoughtful and intelligent conviction that it would be well for them to keep a rest-day once a week, and a loyal readiness to bear their part in the change by forfeiting the pay they would otherwise earn. In my own experience I have never once seen any disposition of a contrary character. I remember with much satisfaction that when increased pay was granted generally for Sunday work, my stokers did not stand out for it. I told them that I feared such an increase would be a temptation to many to desire a continuance of Sunday work, and so hinder what we were aiming at, and they agreed with me. This conduct was not confined to one or two works, but was found, I believe, wherever the men felt confident that every effort was being made to help them to relief from Sunday work. If we look at this action of the men from their own stand-point, it really exhibits a large amount of self-sacrifice.

My paper may, in some respects, have a family resemblance to a sermon—I will increase it by a "personal application." How many of us, after being used to a certain income, would consent to a reduction of of it by, say six per cent., unless we felt there was urgent need for the change which caused it, and yet this is what the stokers do. One other word about the time I have referred to. I think it quite possible that the successful attempts to reduce Sunday work, which has been made in certain London works, accounted for the existence of so much of fellow feeling between employers and employed, as saved both from the miseries that were experienced elsewhere at that time.

I believe that now the practice is generally adopted in all the London works of suspending gas-making from 6 A. M. to 6 P. M. on Sundays whenever possible, and I trust that we shall hear to-day that an increasing number of country works are adopting the same rule.

The plan followed is generally the same as that advised in the report to which I have already referred. Where a weekly change is adopted, the gang leaving work at 6 P. M. on Saturday return at 6 P. M, on Sunday, those leaving at 6 A. M. on Sunday return at 6 A. M. on Monday, each being off for 24 hours. In my own case we prefer a fortnightly change, and consequently, in alternate weeks, one gang has 36 hours off and the other works on. As the charges are gradually burned off on Sunday morning, the exhauster is eased, and stopped when the gas is no longer fit to put in the holders. That remnant is then allowed to escape, by plug-holes, from the hydraulic main.

When it is possible to close up the furnace door and ash-pan, so that there is no in-draught to the setting, the consumption of fuel required to maintain the heat is very slight. At the South Metropolitan works, where the retorts are on the ground-floor, plates are laid across the ash-pans, and breeze heaped over the frame, the chimney dampers closed, and no attention paid to the fire till about 3 P. M, At my own stations for some time (the retorts being all built on the stage plan) the night firemen left undone their last clinker-, filled up the furnaces with coke and breeze at about 4.30 A. M., bricked up the door and ash-pan, closed the main dampers, and so left matters till the day men came in at one o'clock. The bricking up was a rather cumbrous process, and the waste of bricks considerable, so we now leave that out, and bring in the day firemen at 11 A. M. Of course, when the fires are left for eight or ten hours, it is indispensable that any current of air shall be prevented getting through them, otherwise the fuel is burned out, and a very perceptible diminution of the heat is apparent at night.

On the works of the Crystal Palace District Gas Company, a plan is followed which is, in some respects, entirely peculiar. I will note it very briefly, because I trust Mr. Watson will favor us with the details of his procedure. In those works for four months in the year (the summer months) the suspension of work is for 24 hours instead of 12, and the last charge is put into the retorts not at 5 A. M. on Sunday, but at 11 P. M. on Saturday. The night men go on duty as usual at 6 P. M. on Saturday, and work a half shift, all leaving before midnight, they resume work at 12 midnight on Sunday, and work another half shift, thus being off 24 hours. The day men who leave at 6 P.M.

on Saturday resume at 6 A. M. on Monday, thus both gangs work six days each week. For the remaining eight months in the year the work is stopped for 12 hours, as in the case of the other companies. Mr. Watson has all dampers closed when the last charge is in, uses coarse breeze for maintaining heats, and estimates the cost of this most thorough-going suspension at £500 per annum for his large manufactory producing 400 millions per annum. This does not include interest on additional plant required. I feel that much is due to Mr. Watson in this matter for showing by this 24 hours cessation how little need there is to fear injury to retorts or apparatus when proper care is exercised. The manufacturing accounts of the Crystal Palace Gas Company will sufficiently reassure any manager, who may have fears on this head, about embarking on a similar road.

In one respect I think the plan I have named is open to objection. I have always been told by my firemen that it is difficult to muster the men for a six hours turn, and in this case, the same gang has two such turns within 36 hours. Again, the going to work at midnight on Sunday involves the necessity of spending the afternoon in bed. My own feeling is, that a rest from 5 A. M. on Sunday, to 6 A. M. on Monday, would give the men a truer Sabbath, using the word in its literal sense, of rest-day.

I have no doubt that Mr. Watson, in arranging as he has done, has been influenced by the desire literally to "keep holy the Sabbath day," a purpose with which I am sure very many, if not all of us, will thoroughly sympathize. At the same time I must express my opinion, that in this matter I feel more disposed to obey the spirit than the letter; and that I should more consider, and rather follow, the plan which gave the greatest relief to the men, than that which enabled me to conform most closely to the popularly accepted bounds of the Lord's day. I say this in no captious spirit; and while saying it, I feel the sincerest admiration for the course pursued at Sydenham. I merely wish to explain the object I would keep in view always in this matter, viz., to get for the men as much real rest-time as the time of suspended gas-making will allow. Permit me here to say, once for all, that I should take far less hearty interest in this movement, if I thought it unlikely even that the hovrs of rest on Sunday would be used by the men for those great purposes of worship and preparation to which Christian people have ever devoted it, and in which, beyond all comparison, is found the truest and most perfect rest, physical and mental. At the same time, before this Association, I can safely leave such matters, and trust for argument to the political and social side of the question.

It is often said that we should do well to keep our stokers at work on Sundays, until that happy time comes when the public houses will be closed throughout the day. My impression is, that liberating the stokers will not delay that event. I do not think that any other than a small minority of the men spend their leisure time on Sunday in drinking. We very rarely see a drunken man on the works on Sunday night; and there is among working men a large number who recognize that the Sabbath should be a rest-day for the nation, and not for particular classes or trades, and who, therefore, desire and work hard to procure the removal of all temptations to its desecration. Among such are many, probably, who would even resist the temptation to hear a favorite preacher, if he held forth out of walking distance from their homes.

A far more real objection to the cessation of work on Sunday is that named by our esteemed President of last year, viz., that such cessation involves the necessity for increased capital expenditure, and also adds to the expenses of working. We have, in recent years, and I think, especially in London, been striving so hard to produce and sell gas at the lowest possible rate, and our accounts are subject to such examination and comparison, that the addition of one per cent to the fuel account, or a farthing per 1000 to the item of wages is matter sufficient to call for explanation, and to make the engineer dread the appearance of that pretty, but tantalizing book in red cover, the advent of which is now an important event in each season. That this race is entirely wise I very much doubt; and there are points about it that are, in my opinion, both ridiculous and mischievous. Into that I need not now go further than to say that I regard any such argument as being entirely inapplicable to this matter. I think we have a right here to regard the pecuniary as being a consideration secondary to our duty to our men and to society. But to what does this obstacle really amount! I have already admitted that we cannot expect to make in 6½ days the same amount of gas now produced in 7 days, therefore it is necessary to extend the gas-making plant, and we will take that extension at the full amount for 12 hours 'stoppage, say 7 per cent. Let us take the case of a company which require to set aside for dividend 10d. per 1000 feet, out of the price charged for gas; I believe it will be found that that 10d would be just about divided in two if the capital expenditure had stopped at the inlet to the gasholders. We may therefore take 5d. per 1000 as sufficient, and it is more than sufficient to pav interest on that part of the plant which would need extension; 7 per cent. in that gives 35d. per 1000 as the extra charge upon the gas on this head. We now come to working expenses. Allowing the full number of firemen to be on duty, and that they receive full pay, the charge on this head, .05d. per 1000, and an increase in the full account of 1 per cent. on the coal carbonized, all that is necessary with proper management, is equal to 13d. per 1000. Putting together this 35d. on dividend account and 18d. on account of working expenses, it shews a charge against the working of 53d. per 1000 feet of gas sold. Now, I maintain that this is a charge which cannot be held to justify the continuance of a custom so objectionable and injurious; but at the same time, I maintain that it is a charge which, while demonstrable in figures, would not be experienced in practice for the following reasons:—First, almost all gas companies cut their producing plant too close, and are losers through having, at the time of greatest demand, occasionly to stint the supply to their consumers; secondly, and chiefly, from men refreshed by a Sunday's rest, and lifted from the condition of mere working, sleeping (and drinking), machines, we should get superior work, and more of it in the time they do work, and less of that waste due to the indifference with which so many go about their monotonous round. We know from our own experience, and from universal testimony, how much more productive is the labor of men vigorous in health and cheerfull in mind, to that which is put forth when mind and body are jaded by too prolonged exertion. This is so, even where the mind is engaged with the hands; how much more will it obtain when the exertion is only physical, and knows no variety. Under such circumstances, life becomes a condition to endure, not to enjoy, and it would be a wonder were it otherwise than that the chief concern of the workman should be to reach leaving-off time. Do not suppose that, in speaking upon this matter, I am influenced by the specially laborious character of the stokers labor; on the contrary, I think it more than probable, as I have already said, that when the Sunday work is abolished, they will be able and willing to do a larger amount in the time they are on the works, and so reduce the proportion now spent in lounging about doing nothing. It is a strong argument in favor of the economic advantage of the Sunday, that England and America, where the day is most honored, should be the most successful manufacturing countries. The grasping disposition which leads a man to work on and on through the hours that should be devoted to rest or mental culture will, in time, wear out his powers. And so with nations. The fear to do what is right, lest another should pass us in the race, betrays not only cowardice, but unwisdom. The man of method, who determines that within certain hours his work shall be done, so that the remainder may be his own and his family's, is more likely to be successful than the other, who persuades himself that he has always plenty of time, because he can take it from that which should be otherwise occupied.

Mr. Brassey tells of Russian laborers, working for themselves, who start at 2 a.m., and finish at 9 p.m., working about 17 hours per day, and yet accomplishing about one half the work that an English laborer would perform in 10 hours. This may be due partly to superior strength—I am not aware that it is; but it is owing principally to the lassitude that must accompany such injudicious working. In the same way, the continental workman, in seven days, gets through no more work than we do in six, and I firmly believe, no more than he himself would get through in six, after a few months practice. Influenced by such reasons as these, I feel confidant in advising the cessation of Sunday work even to those who are determined to consider first the question of cost.

One word, in conclusion, upon another aspect of the evil. There is no doubt the practice of gas-making on Sunday so accustoms us to work on that day, that we find it very easy to order and arrange for work of other kinds. Mr. Morton declined to speak of work other than carbonizing, holding it to be, I suppose, to bad to argue about. Now I would rather (and so, I think, would we all) with the help of a few men on Sunday, while the great bulk are at rest, make good some failure which needs the stoppage of the works, than run the risk of keeping the majority at work gas-making on Sunday in order to stop for repairs on Monday. But these necessary repairs are few in number, and occur but seldom, while the calling in of the mechanics on Sunday is, in many works, of frequent occurrence. I think it will be agreed that this practice is so slovenly, as well as unkind, that we should strive hard to wipe it out. A gentleman at the head of an important gas undertaking told me when, as a boy, I went over his works with him, that he found the quiet of Sunday a great help to him, because he used it for the making up of his books and reports. For some fifteen years further the same unwise, though unceasing labor was kept up, and then that gentleman had to resign his position because the undertaking had gone backwards instead of improved, and those same books and accounts which had had the benefit of quiet Sundays, were, and had long been, in utter muddle.

If the manager himself respects the day, and uses it aright, he will be able to afford the advantage of it to his men also, and I feel sure that he, himself, his men, employers, and profits, will be the better for it.

I trust that I have not occupied too much time in again introducing this, in my mind, very interesting question, to your notice. It is one that admits of few figures, though, possibly a large amount of argument. We are now, at any rate, in a position to compare notes on the two sides; some of us have had a fairly long trial of the plan, and are certainly not disappointed or disposed to go back from the 12 hours rest. Many here have not yet tried what they can do, and others have tried and given up. Probably this is the last time we shall formally discuss the matter as an Association; I hope, therefore, that, valuable as our time is, at these too short meetings, members will spare enough of it so to ventilate different opinions as to put the matter thoroughly and clearly before the meeting, and then we must of course, leave to every man's conscience the course he may elect to take.

Mr. Hislop, of Ayr, said that he was desirous of warmly recommending the paper just read to the attentive consideration of the members of the Association. It was about eleven years ago since he first commenced the systematic cessation of Sunday labor in the works under his charge, and he could bear testimony to the fact that the change thus introduced had been a real blessing to the men. When he came South and witnessed the way in which Sunday was observed in this part of the kingdom by many, it did not surprise him to find that the cessation of Sunday labor was a general practice; but it would surprise many present to be told that, notwithstanding the strictly Sabbatarian views entertained in Scotland, the cessation of Sunday labor in gas works was not general there. He thought this was a subject which should commend itself to the attention of all the members,

and, as Mr. Woodall had suggested, this might be the last time in which it would be specially brought for ward, he trusted that those who had tried the plan, and realized the benefits it ensured, would fulfil the duty they were under earnestly to press the matter upon their brethren, until what was now the majority would become the minority in reference to the adoption of Sunday rest.

Mr. Fraser, of Inverkeithing, said, like his friend, Mr. Hislop, he felt highly delighted with the paper just read. It was a most excellent, practical paper, and would surely commend itself to every member of the Association. He rose, however, just to mention a kindred matter. Scotland was a large iron-making country, and at one time all the blast furnaces were kept in full work during the Sunday, and it was contended that if the works were stopped, even for half a day on Sunday, the manufacturers would not be able to make iron again until the middle of the following week. At last some persons tried the cessation of Sunday labor, and found there was no difficulty in keeping the furnaces hot, so as to enable the work to proceed as usual next day. This showed that "where there's a will, there's a way."

Mr. Anderson, of Bath, warmly advocated the adoption of the plan recommended by the writer. He believed that every manager would admit that it was a good thing if it could be done, and the experience of those who had practically given up Sunday labor proved that the difficulties sometimes apprehended were not such as to justify the continuance of a system, which on the highest moral and religious ground ought to be abandoned.

Mr. Eldridge, of Richmond, said he entirely sympathized in the remarks which had been made, and believed that it would be impossible to over-estimate the great blessing which Sunday rest would be to the men. But there was one little difficulty he felt in connection with the matter, and he should like to ask some of his fellow-members how he was to get out of it, and that was the pay of the men. Would they be satisfied with one-seventh less wages per week? He thought not. But if they worked six instead of seven days, there should be a reduction.

Mr. Bickerton, of Goole, said he had now no Sunday work, paid the men the same as when he did, and he fully believed the company sustained no loss by the change.

Mr. Simpson, of Rugby, had dispensed with Sunday labor as much as possible for twenty years, and found it worked very satisfactorily.

Many others followed with remarks to the same effect.

Mr. Patterson, of Warrington, said, in truth it resolved itself into a question of whether managers were so favorably circumstanced as that they could leave off working during the whole of Sunday or not. Some could while others could not. He had tried it twenty-five years ago, and the results were not at all satisfactory. He gave holidays to each of his stokers every year, but he did not on any account consider it desirable to suspend Sabbath labor.

Sanitary Principles

We are pleased to see that general attention is being more and more drawn to sanitary precautions, and that there is at present a greater willingness among the enlightened portion of the public to sustain and execute the suggestions of men who, by reason of their special knowledge, are entitled to confidence in this respect.

The impediments to general health are numerous, and we may specify them under different heads, namely: 1st, Defective drainage. 2nd. Smoke from fires. 3rd. Odors from factories. 4th. Contamination of drinking-water. 5th. Illy ventilated buildings.

1*st. Defective Drainage.*—This may affect people living on farms in the open country as well as those living in closely built up towns or cities. It is in every case a result of ignorance and neglect—in fact laziness. Every locality can be drained, if in the open country only a proper system of drainage ditches be constructed, and sewers in town and cities. If the land is so low that the exit of these ditches or sewers come under the level of the watercourses into which the drainage is to go, dams may be constructed, provided with pumps to throw the water out, and keep the sewage in the lower ends of the ditches and sewers at so low a level that they will always be able to drain off all superfluous drainage water from the rest of the surface, when the land is near tide-water, advantage may be taken of its periodical rise and fall by making flood-gates opening outward, and automatically closing when the water rises outside; in this way the inside water may always be kept almost at the level of low tide. This is the way in which those things are managed in Holland, where the greater part of the country is not only below the ocean level, but below the lowest water. By the power derived from windmills and steam-engines, the water from these low flats (mostly the bottom of drained lakes) is lifted into artifical ponds, which, by the automatic flood-gates, are kept as near as possible to the level of low tide.

It may be objected to that such expensive measures are good in over-populated countries, where land is more expensive than in this extensive commonwealth; but it is a fact that in and near our large cities the land is as valuable as anywhere in the world, and that in consequence already measures similar to the above have been taken in some localities; thus the Jersey flats between New York and Newark are being partially drained by means of dams and flood-gates, while the similar flats between Jersey City or Hoboken and the Bergen hills, now a source of fever and ague, will undoubtedly soon follow, but perhaps not before the inhabitants are literally compelled to drain them.

This system of artifical drainege by means of pumping sewage matter against a high head of water, has even been applied in some peculiar low localities in certain large cities of Europe, for instance in London, England, while in Holland the whole extent of several cities depends entirely on such artifical drainage, in some cases even assisted by letting fresh tide-water continually flow in at the opposite end from where the pumps are located.

Experience has proved that the most swampy region, or the most muddy lake bottom, when propealy paid out with ditches and drains, and provided with pumping apparatus to keep the water level at a proper depth below the surface, becomes in a single year perfectly wholesome, the falling rain continually flowing off and being removed, and also continually being renewed from above, exerts such a cleansing influence on the soil as to exterminate all miasmatic influences, which can only flourish in stagnant puddles.

2*nd, Smoke from Fires.*—Smoke is in general not as hurtful to health as other atmospheric impurities, provided it is smoke from ordinary fuel, and not too dense; smoke from many factories, such as bone-boiling establishments, is especially objectionable, and for this reason usually carried up by tall chimneys so high in the atmosphere that there is very little chance of its coming down again and being perceived in the neighborhood. When, however, many facories and steam-boilers throw a great deal of smoke in the atmosphere, as is the case in Pittsburg, Pa., and in most English cities, where bituminous coal is burned, the smoke becomes a nuisance simply from its large amount, and is soon a subject of universal complaint. Such complaints have given rise to the use of smoke-consuming contrivances, of which several have been applied in England, and found so profiable and economical that manufacturers who at first had to be compelled, by special law, to adopt them against their will, changed their minds, and blessed the complainfants and inventors for having caused a considerably diminished consumption of coal.

Smoke consists of various ingredients; the visible portion is mostly finely-divided and unburned carbon, mechanically carried up by the ascending currents of hot gases, then carbonic oxide, caused by carbon imperfectly consumed from a deficient supply of air; this gas is very poisonous, but also very combustible, and is easily ignited over the fire by a proper supply of air. Its combustion may be often observed by night on the top of the chimneys of many of our river steamers. This curious phenomenon must not be mistaken for over-firing to such a degree that the flame comes out of the smoke-stack; inside the smoke-stack there is no fire at all, but only the ascending combustible gas, which, from want of air, can not take fire before it comes in contact with the outer atmosphere. This is of course a waste of heat, as the heat of this flame on top of the flue should be utilized lower down under the boiler, and by a proper arrangement of furnace, such as admission of air below at the right place, can be corrected. This is done in what are called the gas-burning kitchen ranges, where a certain regulated amount of air is admitted over the fire.

Another product of combustion is carbonic acid, evolved by the complete combustion of carbon. Notwithstanding it is a heavy gas, it is carried upward by being expanded by the heat of combustion, and thus made lighter than the air. Lastly, we must mention watery vapor, the result of the combustion of the hydrogen in the fuel, and also of the water which it may contain.

After the above explanation, the reader will appreciate the following item at its real value: "Mr. C. W. Williams, in *Seward's Coal Trade Journal*, in an article on 'The Generation and Characteristics of Smoke,' scouts the idea that smoke can be consumed, or converted to the purposes of heat. He says the cloudy volume of smoke, as we see it issuing from the chimney, 'is merely the great mass of steam or watery vapor, formed in the furnace, but colored by carbon; and when we consider that no less than half a ton weight of water (in the exp nded form of steam) is produced from every ton weight of bituminous coal consumed, we can easily account for the enormous volume and mass of this blackened vapor called smoke, as it appears to our vision, and the palpable error of supposing that this cloud of incombustibe matter was capable of being consumed.'"

If the smoke were really nothing but dirty watery vapor, as the writer states, he would be right; but the experience of the economy of the smoke-consuming furnaces is against him, proving as they do the economical combustion of inflammable gases and of finely divided carbon.

There is another way of disposing of the latter nuisance (the carbon) in an economical way, proving at the same time that there is something in smoke besides watery vapor. We find the following item in a French paper: "At a factory at Menilmontant in Paris, the practical employment of what seemed to be the theoretical solution of getting rid of the smoke nuisance, appears to have been successful. In the chimney-stack a fine spray of water is introduced, which falls through the column of smoke, and this not only washes it, but takes from it the carbon. The impurities are caught at the bottom of the chimney, where they run off into a tank. A certain quantity of lampblack secured in this way amply repays the cost of the introduction of the water."—*Manufacturer and Builder.*

A New System of House Drainage.

Various systems of house drainage and ventilation have been broached by amateurs, tradesmen, medical officers and architects, and as these more or less divide the opinions of sanitary authorities, we may just glance at the principles, previous to laying before our readers the system of "disconnection, which is one of the recent, and, we believe, most efficient, modes of dealing with the question. One of the earliest advocated proposals for rendering our sewers harmless was the connection of these arterial drains with the chimneys of factories. Many able sanitaries and scientists adopted the idea, and under the name of "Stott's System" it has lately again been courting popularity. The system is said to work well at Halifax. Mr. Ainley, the medical officer of the borough,

in a recent letter to the *Building News*, says: "About six months ago very loud complaints came from a certain part of the town. I recommended that Stott's method should be applied, and we have not had a single complaint from that quarter since. And this is not to be wondered at when you bear in mind the amount of air which is drawn out of the drains. Several times I have measured it by the anemometer, and it ranges from 900 to 1,200 cubic feet per minute.

Another plan, more simple, and which found a number of apologists, was the "rain water pipe" ventilation. Now there was something in this plan far more natural and simple, but the very partial manner in which it was applied was sufficient to render it either intolerable or quite nugatory; besides which it often operated in a different manner to that anticipated. The down pipes became downcasts in some cases in the lower levels, and they tended rather to disturb the air in the sewers than do good. Several towns, we believe, adopted the plan, and some surveyors are found recommending it now. Another and a recent plan is the connection of the gas lamps with the sewers, but this operated in the same way, chiefly from the partial way it was tried. A still more recent and largely applied system is that of deodorizing the gas by allowing it to pass through charcoal trays placed in gratings over the crowns of the sewers. Mr. Latham's charcoal ventilator has been largely and beneficially used in this way; but an objection has been practically found to this system. The charcoal is apt to become saturated and dampness renders the disinfectant useless. It requires a great deal of attention and constant renewal of the charcoal. We pass on to notice the "soil pipe" system of ventilation, which is now recommended, and has been employed with greater success than any other. Several plans, and patents innumerable, are before the public; many of them, however, are tradesmen's nostrums in the shape of complicated traps. Now, before noticing any of these, let us first remark that the simplest plan—too unremunerative, however, for plumbers—is to give a free outlet to the soil pipe, and this mode has been largely adopted of late, and consists of carrying up ventilating pipes from the uppea bend, or top of the traps, to the roof or some harmless point of exit. In addition to this various traps have appeared, some ventilating, others fitted with charcoal filters, and purporting to be more or less perfect in construction. Mausergh's patent ventilating trap is a type of some of the improved appliances, combining an open grating for surface water, a trap for tne soil or waste pipe, and a ventilator. Mr. Jennings and Messrs. Doulton have also patented syphon traps of considerable merit, answering both as traps and ventilators. These improvements have partly met the evil which the old simple water-seal "dip" trap failed to do; they give a vent to the water bound gas, and also a constant escape to the lighter gases evolved within the drains. Another stroke of ingenuity is needed, however, to make the house-drains perfect ventilators, and to this point we wish particularly to refer. We believe, with a proper upper exit for the gases, a lower inlet for fresh air should be provided, insuring, as far as the sewage gases are concerned, a complete isolation or disconnection between the outer and inner drains of a house. This may be done simply by cutting off the drain of a house in a ventillating cesspool, or allowing it to discharge upon a grated opening, at which point, also, the sewer would be trapped by a syphon, thus completely intercepting the gases of the sewer outside the house. Lovegrove's ventilating trap partly answers this reduirement, the drain having a bend or syphon-trap, with a ventilating shaft carried up from the centre "dip." It is evident by this arrangement a current of air may be created from this lower outer cesspool, or open syphon, through the house-drain and up the soil-pipe to the upper exit, always cleansing it, and driving out of it any foul air that may be generated. Thus the lower outside ventilating cesspool and the upper soil-pipe outlet combined become means of completely disconnecting or locking off the sewer from the house. Instead of carrying a ventilating pipe from the house closet traps to the roof, it has been proposed to insert at any or every such trap in an external soil-pipe a "ventilating junction," through which the gases (if any collected) could escape at the level of any floor readily, without having to travel up a long pipe to the roof, often impeding its free passage. A little reflection will show that nothing noxious could arise from these "junctions" or ventilators being placed outside a closet and opening into the air, for the least accumulation would be driven out by the current from the lower inlet; and, further, it is impossible to imagine a pipe always open at both ends capable of retaining any gas of an injurious nature at all. It *can* have none; for the product would be constantly escaping. This "through" system of ventilation, or what we may call the "air cleansing, circulating mode of disconnection," appears to possess all the essentials of the most perfect drainage system yet devised for houses. Every flushing, instead of forcing the wate-bound air through the nearest water-trap, facilitates the cleansing. The outer system of the sewer is completely shut off, and the most contaminated and gas-charged drains can be harmlessly connected, for isolation as perfect as can be desired is attained. The above system, suggested by us many years ago, has lately been put into successful operation. We may refer to the patented appliances of Mr. Banner, whose name has been much before the public lately, and who has adopted this idea in combination with ventilating cowls and traps, but we would point to the fact that the principle admits of the easiest application, and can be divested of all complex apparatus. The system may, moreover, be adapted to any dwelling by the introduction of an external ventilating cesspool or syphon, or by simply inserting an air-pipe into the inlet part of any external trap, and, further, making an outlet at the top of the soil-pipe, so as to create a through current of air. With such a simple mode of removing one of the most palpable evils of our sanitary system, we cannot believe, whatever our backwardness in such matters may be, that our gas-bound apparatus of house-drains will be tolerated, in spite of its admitted consequences upon the health of our communities. The Social Science Association has, we rejoice to find, under consideration some suggestions for recommending an extention of legislative enactment in the matter of house construction. Let us hope the suggestions will be speedily put into the shape of practical law, and that house-drainage will be placed under the control of sanitary authorities competent to grasp the most intelligent, thorough and expeditious means of checking the evil. "Properly trap your drains," has been the set phrase and watchword among sanitary surveyors and authorities for the last generation or two; the trap was looked upon as the panacea for all evils, the very perfection of drainage; though it never occurred to those well-intentioned officials that by trapping we are merely giving the foe a more deadly concentration and power, making it more energetic and crevice-finding. The old brick drains and "dip-stone traps" of forty years ago were bad enough, but they were permeable and imperfect; and their very imperfection became a good. When the glazed, socketed stoneware pipes and syphon-traps were introduced an air-tight system took their place; and yet we find in the early days of the Public Health Law, the notion prevailing that plenty of flushing, and small house drains with traps, were all that was required to insure an effectual removal of drainage and sewer gas. So confident were some of the sanitary engineers and surveyors of that time tn the efficacy of flus ing a small pipe for driving before it all deleterious matter, solid and gaseous, that many house-drains were specified to be only 3 inch bore, and larger barrel drains were replaced. It soon became apparent, however, under this system, that the mischief grew more imminent and dangerous, and the outbreak of epidemics quickly made surveyors and local boards of health conscious of the forcing power of sewer gas, and that unless relieved freely it became more potent for mischief. Investigations and experiments convinced the most ardent follower of "flushing and traps," that the greater the flushing power in a drain, the more urgent is the need for an escape of the water-bound air, and that failing this, it travels as quickly back along the pipe in air-bubbles as the velocity of the flushing current itself, forcing its way backwards through traps of the best construction. These experiences alone convinced the public that ventilation was as much a necessity as drainage itself, and that there existed something far more subtle and deleterious in its effects upon public health, and which had to be dealt with in as complete and tangible a manner before the health rate of large towns could be increased.—*Public Health.*

Chemical and Scientific Repertory.

Is Cement a Corrosive?—The recent gas-explosion in the Capitol at Washington led to the discovery that the iron pipes embedded in cement were mere cylinders of rust, so completely were they honeycombed by the corrosive effects of the cement.—*Am. Architect and Building News.*

Flushing Sewers.—The Hamburg sewers, which were laid in 1843, are flushed every week at low tide by turning into them the water of the Binnen Alster, the waters of which pass through them with such violence as to cleanse them so perfectly that the siphon under the river has not needed cleaning out since 1845.—*Ibid.*

BRICK WORK.

A rod of brickwork=272 superficial feet, 1½ bricks thick, or 4,350 bricks average work. One yard of paving=36 bricks flat or 52 on edge. There are 384 bricks to a cubic yard, and 1,000 bricks, closely stacked, occupy about 55 cubic feet.—*Sci. Amer.*

NAIL MAKING.

The Wheeling *Intelligencer* says: "It is said that more nails were manufactured in this city during the last six months than ever before during the same length of time. We have the figures of three of the principal factories, as follows: Riverside, 146,300 kegs; Belmont, 130,000 kegs; Top, 126,000 kegs. The product of the other mills was in proportion to the above, according to the number of machines in operation. Wheeling has justly earned the name of ', Nail C'ty."

SHIP BUILDING IN VIEGINIA.

We learn from the Philadelphia *North American* that the Atlantic Iron Works, near Norfolk, have been leased by a New York manufacturer, who has purchased the machinery, and is backed by a Northern company of capitalists interested in shipbuilding. The enterprise promises some increase in iron activity and a very useful increase in the construction of iron ships. A marine railway witl be constructed at once. The building and repairing of ships will be the principal industry, which cannot fail to increase hereafter in harmony with the generrl welfare.

Nepune in Hot Water.—The blazing heat of the last two months has not only toasted the dry land; it has stewed the sea. Capt. Cook, of the Russia, just arrived, says that he never experienced anything like the heat of the ocean on the passage which landed him here on Wednesday morning. It was far worse than anything we have suffered on shore, for there was no shade and no wind. The Gulf Stream, it appears, has extended much farther to the northward this year than usual, and we can well imagine the sensations of passengers carried for days through water 80° hot, with the Dog Star raging above.—*N. Y. World.*

Steam Power for Street Cars.—Two separate trials were lately made in Edinburgh of Grantham's patent tramwa y car, propelled by Shand, Macon & Co.'s patent steam engine, with tubular boiler, The

trials took place on the tramway rails of the Woodside Ferry and Hoylake Company. The car runs on a bogie with four wheels, the other end of the machine resting on two wheels. The latter being small, an acute curve is taken with facility. On a level part of the line the speed attained was not less than fourteen miles pes hour, The car can be stopped as suddenly as one drawn by horses. It is claimed for the engine referred to that it gives 12 horse power on a consumption of ½ cwt. of common gas coke per hour, or the work of 12 horses for 19 honrs, at the cost of 5 cwt. of common gas coke, or less than $1.25. Out of fifty or sixty horses met by the car four of them shied on its approach. A small quantity of smoke was emitted from the funnel when the car stopped, and some when the steam passed throngh the safety valve.—*Scientific American.*

PIPES.—Pipes capable of resisting a pressure of twenty atmospheres have been made in France, from endless paper saturated with coal-tar. They are said to be almost indestructible, strong, and light; moreover they are poor conductors of heat, and are cheap. In 1841 an attempt was made to introduce the use of glass pipes of about seven inches diameter. It was urged that these pipes could be produced at about one-third the cost of cast-iron pipes, were practically imperishable, and would sustain a pressure of 100 atmospheres. Of course their fragility rendered the attempt unsuccessful; but if M. de la Bastic succeeds in perfecting his "toughened glass," or M. Piefer's "vulcanized" glass turns out to be a practical invention, there seems to be no reason why, in certain positions, glass pipes might not be used to great advantage. If they ever are used, it will put an end to the reign of "practical" plumbers. Any householder can himself discover where the pipe has become stopped, and can call in an artisan who will not have to cut a pipe half a dozen times before he can locate the stoppage. There will be no more danger of solder getting inside the pipe when a joint is made; but if cement, or whatever is used for making a joint, does get inside the pipe, it can be at once detected by inspection.—*Amer. Architect and Building News.*

STEEL HAWSERS.—The introduction of large ships of war has rendered the old-fashioned hawsers comparatively useless. It is found impossible for men to handle larger cables and hawsers than are used for 6000 ton vessels. For this reason some new experiments have been made with steel hawsers at Davenport, under the authority of the British government. The steel hawser used was eight inches in circumference against a hemp one twenty-gve inches in circumference. The report as to handness in working was entirely in favor of the steel wire hawser. Another great consideration is that 120 fathoms of 24 inches hemp cable weighs 7 tons 16 cwt., while the same number of fathoms of 8 inch wire cable, which is equal to, if it does not exceed, the strength of the others, weighs only 2½ tons. The wire rope which was tested is equal in strength to a 2½ inch chain, the weight of which would be 16 tons.—*Iron Age.*

Gas-Light Intelligence.

Great Britain.

SUGG VS. SILBER.—This case came on again in the High Court of Justice on June 13, Queen's Bench Division. The defendant applied for a new trial, on the ground of misdirection, which was granted, the judges sitting in banco being Mr, Justice Blackburn, Mr. Justice Mellor, and Mr. Justice Field. This case was again before the court on June 26, and has resulted in the verdict for the plaintiff being set aside. Mr. Watkin Williams, Q.C., Mr. Cave, Q.C., and Mr. Webster appeared for the plaintiff; and Mr. Aston, Q.C., Mr. W. Harrison and Mr. Macrory appeared for the defendant.—*Ironmonger.*

Our old friend, Mr. Lewis Thompson, continues the publication of his little pamphlets. The last which has reached us is entitled "The Miner's Curfew, and other matters, Social and Political." In the "Miner's Curfew," Mr. Thompson describes an apparatus he has devised for giving warning when an accumulation of fire-damp takes place in a working. We need not quote the description. The next paper on "The Manufacture of Illuminating Gas without the Use of Coal," will most interest our readers. Mr. Thompson would appear to believe that the manufacture of coal gas is doomed to extinction. "The days of gas nastiness," he says, "are numbered * * * The glare, the flare, the soot and smoke of gas works, the stench and nuisance of the gas tar, the gas lime, the gas liquor, etc., will proclaim with prophetic accuracy, that things cannot be allowed to remain as they are." The idea which has taken possession of Mr. Thompson's mind is, that the manufacture of coal gas may be superseded by the production of a mixture of nitrogen, carbonic oxide, and a little hydrogen, which is formed when atmospheric air is passed over or through a mass of incandescent charcoal, the mixture so produced being subsequently carburetted by carrying it through a vessel containing a light petroleum spirit (benzoline). Living secluded, in a Bedfordshire village, the author probably is not acquainted with the numerous inventions patented within the last few years for carrying out his idea. That every one, up to the present moment, has failed, we need hardly say. There is, we believe, a possible future for carburetted "water gas"; but, in the absence of the Lewis Thompson of twenty years ago, we despair of seeing much progress made in the practical application on a large scale of the process described in this paper. The manufacture of coal gas has the "long day," which an Irishman asks for when he is sentenced to be hanged, and the best advice we can give our readers is, to persevere in their endeavors to reduce the concomitant nuisances to a minimum.—*Journal of Gas-Lighting.*

GAS GLOBES.—A correspondent to a contemporary upon the subject of gas globes remarks: "It is not generally known what a very large proportion of light is obstructed by the glass globes or moons so frequently used over gas flames. From experience it is found that all burners made with a light equal to 15 standard candles yield the following results:

	Illuminating Power.	Percentage of Lost Light.
Naked flame	15.00	...
Clear glass globe	12.80	14.65
Ground	11.40	24.00
Opal	9.00	40.00
Another opal globe	8.16	45.60
" " "	8.00	46.70
" " "	6.64	55.90
" " "	8.00	46.70
" " "	7.48	50.10

The advantage derived from the use of these moons is that they soften the glare of the naked light which is sometimes oppressive to the eyes. Of the opal globes, the dead white semi-opaque should be avoided. A very good form of globe is that with a wide opening at the bottom. which allows a considerable amount of light to be reflected downwards from the white surface of the inside of the globe." [We have recently seen some new kinds of gas-light reflectors, which appear to possess peculiar merits for softening and yet intensifying the light downwards.—EDIOR.]—*Ironmonger.*

An Oil Train Burned.—At half past five this morning (August 12) a loaded oil train on the Central Railroad of N. J., broke in two one mile west of Roselle. The detached cars stopped and a second oil train ran into them in the fog, just above the depot. The locomotive was disabled and the caboose and three oil cars were thrown off the track. The fire in the locomotive ignited the caboose and four of the oil cars, the caboose, and a wooden tank were consumed in a short time. The oil in three other cars burned so fiercely that trains could not pass on either tract, and travel was stopped about ten hours,—*N. Y. Herald.*

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—ED.

BOSTON, August 5, 1876.

Mr. Editor: Believing that your Journal is read as exclusively by men of good sense as any publication in this country, I have no fear of their being misled by the article from Treverton, in your issue of the 2nd instant. It will, I trust, invite due attention to the communications to which it refers, as I venture to state, that either Mr. Farmer or myself would prefer to expound our own views, than trust the elaboration of them to the erudite from Treverton.

Further, I have no purpose to enter into a controversy with the gentleman, or his peculiar notions, as to his chronic complaint about his "wind and water." He is not so explicit as to enable me to prescribe for him with entire satisfaction. Yours truly,

DR. M. W. KIDDER.

Calculating the Speed of Wheels and Pulleys.

BY MR. JOSHUA ROSE.

Although we are constantly solving problems as to the speed of wheels of given dimensions and the dimensions of wheels revolving at given speeds, inquiries on this subject come to us in such numbers that we cannot do better than give some plain, authorative rules which all mechanical readers will do well to remember.

To find the number of teeth in a gear wheel, revolving at a given speed;—Multiply the speed of the driving wheel in revolutions per minute by the number of teeth it contains, and divide by the speed of the driven wheel, and the quotient is the number of teeth required. Example:—If a wheel contains fifty teeth and makes twenty-five revolutions per minute, what number of teeth must a wheel contain to gear into the first, if it make 125 revolutions per minute? $50 \times 25 = 1250 \div 125 = 10$, the answer. For pulleys, or band wheels, the rule is the same, except that the diameter of the wheel is taken instead of the number of teeth. Example:—A driving wheel is 24 inches in diameter, and makes 120 revolutions per minute; what size of pulley must be used to obtain sixty revolutions per minute? $120 \times 24 = 2880 \div 60 = 48$, the answer.

Another rule, which will answer whether we employ a single pair or two pairs of pulleys, is as follows:—Divide the speed required by the speed of the driving shaft, and the quotient be the proportion between the revolutions of the driving shaft and the revolutions required. Then take any two numbers that will, when multiplied together, give a product equal to that proportion; one of such numbers will form the relative proportion between the sizes of the first pair of pulleys, while the other number will form the relative proportion between the sizes of the other pair. Example:—It is required to run a machine at 1200 revolutions per minute, the driving shaft making 120 revolutions per minute. What sizes of pulleys should be used? $1200 \div 120 = 10$. Then:—$5 \times 2 = 10$, or $4 \times 2\frac{1}{2} = 10$; so that the proportion being 10 to 1, we may use two wheels of any sizes, provided that the one on the driving shaft is ten times as large as the one on the machine. Or since $5 \times 2 = 10$, we may place on the driving shaft a pulley 5 feet diameter and belt it to one of 1 foot diameter, thus forming the proportion between the first pair of wheels of 5 to 1. The next pair of pulleys must be in the proportion of 2 to 1, that is to say, we may belt together a 2-feet and a 1-foot pulley, a 4 and a 2-feet, or any others, so that one is twice as large as the other. Again, since $4 \times 2\frac{1}{2} = 10$, our first pair of pulleys may have the proportion of 4 to 1, and the second pair the proportion of 2½ to 1, or *vice versa*, as circumstances may require.

It is obvious that, when the speed of the driving shaft is less than the speed required, the larger pulley of each pair must be used as the driving wheels. *Iron, June* 10, 1876.

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WEDNESDAY, AUGUST 16, 1876.

The Importance of a Practical Knowledge of Clothing,

By MARY WILLIS.

1. The ignorance prevalent among the people with regard to needlework, and the cutting out and preparing of the simplest and most necessary clothing, is an evil daily felt, and appears to us to be on the increase in all classes alike. It is therefore, much to be deplored that measures should not be taken to make needlework and its accessories an obligatory part of female education.

2. Few young ladies upon whose accomplishments hundreds of pounds have been spent, can dress a doll decently or shape a petticoat for themselves, though they may be quite able to work point lace stitches and Berlin-wool patterns. The experience of the lady manager of any parochial or village work society will furnish abundant instances of the deplorable incompetence of the willing volunteer assistants upon whom she must necessarily depend for help in cutting out, &c. I have known of a strip five inches wide torn from a piece of calico sixty yards long, and thus wasted, because the cutter-out was incapable of fitting a shirt pattern to the material she had undertaken to convert into those useful garments, thereby largely raising the price of the smaller number of shirts produced. In a lower class it is a rare thing to find a girl going into service who is capable of making her outfit properly. The little instruction she gets at her parish school is of the most perfunctory and imperfect character. It becomes daily more difficult to find a servant capable of being intrusted with the ordinary mending and darning needed in a household, and it will generally be found in the case of one who can work that she has had the luck to be trained by some superior or nurse or careful mistress, from whom she has gained the knowledge that she had not the chance of acquiring at the school where she was taught to read, write, and cast accounts very tolerbly. There are, of course, some exceptions, as there are some schools where needlework in all its branches is most admirably taught, but they are few. From long experience as a housekeeper we can certifiy to having only had two female servants who had acquired at school a satisfactory knowledge of cutting out and fitting. A certain and almost invariably tasteless skill in millinery is common enough, which is to be ascribed to the powerful influence of the characteristic vanity of the daughters of Eve, in all classes, and is capable of co-existing with a total incapacity to cut out and neatly make the most ordinary garment.

3. It is curious to see now the deftness of hand acquired in good sewing will manifest itself in other things, as it will almost invariably be found that the servant that is handy with her needle is the one to be tausted with the best china, or to arrange a bouquet for the dinner table in the absence of her mistress.

4. Perplexing as this ignorance is felt to be by the mistress of servants, how much more trying and pernicious is this incapacity, when these handless women come to marry, and have homes to care for and children to clothe; and it is on this account that we would so strongly urge upon all connected with schools and teaching, the paramount importance of early and careful training in needlework in all its branches, as it is only in youth that this skill of hand and eye can be obtained with ease and certainty.

5. Occupation which encourages the use of the hands has besides an invaluable moral influence upon children, we believe, and is not half enough considered in our schools for boys as well as girls. It is not found that Scotch children are behind ours in book learning, though the shepherd lads knit their own stockings, and much of the fine white embroidery used for trimmings is in Scotland made by boys. In large orphan asylums and institutions it has been found that the teaching of tailoring and shoemaking has a most marked influence upon the happiness and well-being of the boys; it is much to be deplored that in similar institutions for girls the instruction, often excellent in itself, is still of a kind that is practically useless in after life. I therefore look with much anxiety for the devising of some means by which instruction of the sort we urge could be obtained by those who have left school; and we are convinced that it would be anxiously sought after, not only by those womon who find themselves incapable of achieving their necessary needlework in service, but afterwards, when a knowledge of the quantities required and the greatest economy are needed in cutting out and making their own and their children's garments. I say nothing here of the difficulties many women experience who have to make their bread by needlework and dressmaking. Prizes should be offered in our schools and work societies, not only for excellence in actual needlework, but for the exhibition of practical skill and economy in cutting out garments.

6. As a rule, the petterns used in parish schools and societies are anything but good and economical, and much could be done to amend this if means were taken to provide every school with really good paper patterns, pasted upon cotton material to make them durable, which could be lent out, and on which children could receive instruction in planning and cutting out. In the late examination on this subject, nothing was more striking than the want of acquaintance with the use of patterns and of skill in economising material among the candidates, many of whom showed a sufficient knowledge of the mechanical use of the needle; only two of the examinees produced really good and practicable patterns.

7. The demand for real practical workers increases daily, now that everbody dresses better than in the olden time, when variety of materials was less, and people were content with much more limited wardrobes; the rate of remuneration for good work has risen in proportion, and this makes it the more imperative that something should be done to facilitate the acquirement of an art—for it is an art, even when applied to the most ordinary articles of clothing—that is so indispensable.—*Journal of the Society of Arts.*

Explosion of Kerosene in Hoboken.—About four o'clock this morning Mrs. Mary Smith, residing on Newark street, Hoboken, endeavored to extinguish a kerosene oil lamp by the old process of blowing down the chimney. The flame descended into the globe which contained the fluid and a terrific explosion ensued. The burning oil was scattered over Mrs. Smith, and set her clothing on fire. She was frantic, and ran screaming about the house for help Some neighbors ran into the house, and after some difficulty succeeded in putting out the fire which ha ignited the furniture, and also smothered the flames which were burning up the unfortunate women. She was frightfully burned about the body and face. City physician Pindar was called and attended the sufferings of the woman. He is of the opinion that she cannot survive twenty-four hours.—*N. Y. Evening Telegram.*

Haste is not always Speed.—No two things differ more than hurry and dispatch. Hurry is the sign of a weak mind; dispatch of a strong one. A weak man in office, like a squirrel in a cage, is laboring perpetually, but to no purpose, and in constant motion without getting out of the spot; like a turnstyle, he is in everybody's way, but stops nobody; he talks a great deal, but says very little; looks into everything, but sees into nothing; has a hundred irons in the fire, but few of them are hot; and with those few that are, he only burns his fingers.—*Industerial Monthly,*

Price of Gas.

The following prices are *official*, having been furnished to the AMERICAN GAS-LIGHT JOURNAL by the officers of the various Gas Companies.

Albany (Peoples) N. Y.	$2.75	
Annapolis, Md.	3.40	
Atchison, Kansas.	4.50	
Austin, Texas.	6.00	
Allegheny City, Pa.	1.80	20 p. ct. off prompt pay
Albany, N. Y.	2.75	
Ashland, Ohio	3.50	Street lamps 4½ hours 17 nights per month $15 per annum.
Augusta, Ga.	4.00	Net.
Anderson, Ind.	3.50	Crude petroleum.
Ashtabula, Ohio	2.00	Wren's process; $10 for 80 candle gas.
Auburn, N Y.	3.50	5 p c off prompt pay.
Allentown, Pa.	2.50	$18 per an street lamps Meter rent 10 cents per month.
Ashland, Pa..	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Brooklyn, B'klyn.	2.75	
" Citizens.	2.75	
" Nassau.	2.75	
" Metropol'an	2.75	
" Peoples.	2.75	
" W'msburgh	2.75	
Brockton, Mass.	3.80	
Batavia, N. Y.	3.00	
Bridgton, N. J.	3.50	
Bangor, Me.	3.00	
Boonville, Mo.	4.50	
Brownsville, Tenn.	4.50	
Belfast, Maine.	4.00	10 p. c. off bills over $10; 5 p. c. off bills under $10.
Brockville, Ontario.	3.75	
Bloomfield, N. J.	3.75	
Belleville, Ill.	3.50	
Bellaire, Ohio.	2.85	5 p ct. off prompt pay.
Barnesville, Ohio.	3.00	5 p ct. off prompt pay. Street lamps $17.50 per ann. Burn till 12 P. M. on moonless nights.
Boston, Mass.	2.25	
Bath, Maine.	4.00	12½ p c off prompt pay.
Bayonne City, N. J.	4.00	Net.
Binghampton, N. Y.	4.00	10 p c off prompt pay on bills for 1000 per month.
Buffalo G L Co., N Y.	2.50	10 p c off prompt pay.
Buffalo Mutual, N Y.	2.50	10 p c off prompt pay.
Buffalo Citizens, N Y.	2.50	10 p c off prompt pay.
Bloomsburg, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Burlington, Iowa	3.75	15 p c off bills of $100, and 2g p c over $200. Street lamps $25.22 each, per annum.
Cleveland, Peoples, O	2.00	
Cumberland, Md.	3.00	
Charleston, W. Va.	4.00	25 p. ct. off prompt pay Meter rent 25, 30, and 50 cents. per m. for 3, 5 and 10 light.
Cincinnati, Ohio	2.25	
Columbia, Mo.	4.50	
Carondolet, South St. Louis, Mo.	3.00	5 p. ct. off prompt pay,

Chattanooga, Tenn.....	3.00	
Cold Water, Mich.....	3.25	
Chicago, Ill.....	2.50	
Columbia, Pa.....	2.85	Lowe process.
Charlottesville, Va.....	2.50	Meter rent 20 cents.
Cedar Rapids, Iowa....	4.50	50 cts p M. off prompt pay.
Cairo, Ill.....	3.75	50 cts added if not paid by the 5th.
Cortland, N. Y.....	4.00	25 cts p M. off prompt pay.
Cairo, Ill.....	3.75	50 cents per month off prompt pay. For 20,000 feet a month $2.50.
Chillicothe, Ohio.....	3.00	
Camden, N. J.....	3.16	5 p c off prompt pay; 10 p c off for 100,000 per year.
Carson City, Nevada...	8 00	Gas from wood and Cannel coal.
Cadiz, Ohio.....	3.50	10 p c off on 500 feet or less; 50 cts per M. on from 500 to 2000; 20 p c off on 2000 and upwards.
Derby, Conn.....	3.60	10 p. c. off prompt pay, and 50 cts per M. on excess of 5000 ft. per month.
Decatur, Ill.....	3.50	50 cts. per M. added, if not paid by 10th.
Danbury, Conn.....	4.28	For less than 5000 per month.
" "	3.85	For over 5000 per m th
Dover, Del.....	3.60	
Dunkirk, N Y.....	2.50	Street lamps till 12, moonless nights $25 per annum.
Defiance, Ohio.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Delaware, Ohio.....	3.00	No charge for meter.
East Boston, Mass.....	3.00	
East St. Louis, Ill.....	3.50	5 p. c. off prompt pay.
Evansville, Ind.....	3.00	City lamps $30.
Erie, Pa.....	3.00	City lamps $28 p. an.
Elkhart, Ind.....	3.50	
East Newark, N. J.....	4 00	
Eastchester, N. Y.....	3.50	
Elizabethtown, N. J...	3.00	
East N Y (Union) L I.	3.00	
Eastport, Me.....	4.00	
Fredericksburg, Va.....	3.40	
Flint, Mich.....	3.50	
Franklin, Pa.....	3.00	
Fall River, Mass.....	3.00	
Freeport, Ill.....	3.80	
Fort Scott, Kansas....	4.50	
Flatbush, L. I.....	3.50	
Fredonia, N. Y.....	3.00	Street lamps $25 per annum; burn fill 12 P. M.
Guelph, Ontario.....	3,50	
Geneva, N, Y.....	2.50	5 p. c. off prompt pay. Wood and oil gas.
Greensboro, N. C.....	4.00	
Galena, Ill.....	4.50	Meter rent 25 cts. per month.
" "	4.00	After September 1st.
Grand Rapiids, Mch..	2.80	For less than 1000 feet per month.
" " "	2.50	For over 1000 cet per month.
		10 per ct discount on 300,000 ft annually
Gloucester, N. J.....	3.15	5 p c off prompt pay.
Greenwich, Conn.....	2.40	Wren's process
Goshen, Ind.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Huntsville, Ala.....	3.50	
Hempstead, L. I.....	4.00	
Huntingdon, Pa.....	3.80	10 per ct. off prompt pay.
Hagerstown, Md.....	3.75	
Hamilton, Ohio.....	4.00	
Hillsdale, Mich.....	3.50	
Holyoke, Mass.....	3.01	
Hartford, Conn.....	2.75	
Hornellsville, N. Y....	3.50	50 cents per 1000 off prompt pay.
Honesdal e, Pa.....	4.00	12½ cents meter rent per month.
Hannibal, Mo.....	3.00	No meter rent.
Ithaca, N. Y.....	4.00	5 p. c. off prompt pay.
Indianapolis, Ind.....	2.50	
Indiana, Pa.....	3.00	10 p. c. off prom pay Meter rent 50 cents per month.
Jersey City, N. J.....	2.75	
Joliet, Ill.....	3.50	
Jacksonville, Ill.....	4.00	12½ p.c. off prompt pay.
Jefferson City, New Orleans, La..... ...	4.00	
Johnstown, N Y.....	3.50	
Knoxville, Tenn.....	3.00	Meter rent 15 cents.
Lyons, N. Y.....	4.00	
Lima, Ohio.....	3.80	
Lynchburgh, Va.....	3.00	5 p. ct. added to bills not paid in 5 days.
Louisiana, Mo.....	4.50	
La Crosse, Wis.....	4.50	50 cents per M. off prompt pay.
Lancaster, Pa.....	3.00	
Louisville, Ky.....	2.70	5 p. c. off prompt pay.
La Porte, Ind.....	3.50	Wood and oil gas.
Lowell, Mass.....	2.50	25 cents per 1000 off prompt pay.
Lafayette, Ind.....	2.75	
Lexington, Mass.....	2-40	Wren's process.
Los Angelos, Cal.....	6.00	
Lockport, N Y.....	3.20	Less 20 p c per M. if paid within 30 days.
Millville, N. J.....	3.12	
Milford, Del.....	3-50	
Marquette, Mich.....	3.50	
Morris, Ill.....	2.00	For 15 candle power, or $10 per M. coal gas meter measure (Petroleum Gas—Wren's patent).
Meriden, Conn.....	3.93	
Marietta, Ohio.....	3.50	20 cts. per M. off if paid by 6th. Consumers over 3000 ft. 30 cts. additional discount.
Marshalltown, Iowa...	4.50	50 cts p M. off prompt pay.
Meadville, Pa.....	3.50	25 cts p M. off prompt pay.
" "	2.50	For over 10,000 ft. per month,
Madison, Ind.....	3.75	25 p c off if paid in five days: 25 to 40 cents per month meter rent.
Monroe, Mich.....	3.50	5 per ct off prompt pay
Malone, N. Y.....	4.50	
Middletown, Conn.....	3.56	Net.
Mount Sterling, Ky....	4.50	
Monongahela, Pa.....	2.75	Under 5000 feet m'th $2.75 per M.; over 5000 feet per month $2.50 per M.
Minneapolis, Minn....	5.00	10 p c off prompt pay.
Mahanoy City, Pa.....	10.00	70 candle; 20 p c off prompt pay. Patton's process
Morristown, Pa.....	3.00	18 candle coal, an
New York, New York.	2.50	
" " Harlem....	2.75	
" " Manhattan	2.50	
" " Mutual.....	2.50	
" " Mropolitan	2.50	
" " Municipal.	2.50	Water Gas.
Nashville, Tenn.....	2.85	
Newark, Citizens, N.J.	2.85	
Norfolk, Va.....	3.10	
New Brunswick, N. J.	2.70	
Newton, N. J.....	4.00	
North Attleboro, Mass.	3.50	
New Britain, Conn.....	3.70	
New Haven, Conn.....	2.75	
Nantucket, Mass.....	3.00	Meter rent 15 cts. p. m.
Newark, N. J.....	2.85	
Niagara Falls, N. Y....	3.50	20 cts p M. off prompt pay.
Norwalk, Conn. ..	4.00	12½ p ct off prompt pay.
New Albany, Ind.....	3.00	
New City, Montreal...	2.50	Street lamps, $22 p an
Oswego N. Y.....	3.15	5 p. c. off prompt pay.
Ottawa,, Ill.....	4.00	12½ p. c. off promptpay
Omaha, Nebraska.....	5.00	
P'keepsie, Citizens....	2.70	Gwynne Harris process
Paterson, N. J.....	3.80	10 p c. off prompt pay, and in addition 5 p.c. on bills of $200; 10 p. c. on bills of $1000
Portchester, N. Y.....	3.50	
Pittsfield, Mass.....	3.50	5 p. c. off prompt pay, and 10 p. c. off on bills of $350 per an
Portland, Me.....	3.00	
Paris, Ky.....	4.50	Meter rent 25 cts. p m.
Portsmouth, N. H.....	3.22	
Pittsburgh, Pa.....	1.00	
Philadelphia, Pa.....	2.15	
Painesville, Ohio.....	3.50	
Pawtucket, R. I.....	2.80	5 p c allowed on bills of $500, and 10 p c on bills of $1500 for six months.
Providence, R. I.....	2.25	
Pottsville, Pa.....	3.50	10 p ct off promp pay,
Plainfield, N. J.....	3.50	5 p ct off for less than 5000 a month.
		10 per cent more than 5000 a month.
Peoria, Ill.....	3.50	
Paducah, Ky.....	4.00	10 p c off prompt pay.
Plymouth, Pa.....	10.00	70 candle. Patton's process.
Pottstown, Pa.....	3.20	Public lamps till 11 P. M., 18 nights per month $20 per lamp.
Poughkeepsie, N Y....	2.60	10 p c off prompt pay
Port Huron, Mich.....	3.50	
Quincy, Citizens, Mass.	5.00	
Quincy, Ill.....	3.50	
Quebec, Ont.....	2.40	
Rome, N. Y.....	3.60	
Rochester, N. Y.....	3.00	
" Citixens...	3.00	
Rondout, N Y.....	3.60	
Rockford, Ill.....	4.00	5 p c off prompt pay; 10 to 25 p c off on bills for 500 to 25 M, feet per month.
Richmond, Ind.....	3.00	50 cents added if not paid by 20th.
Syracuse, N. Y.....	2.75	
Springfield, Ill.....	3.25	$25 for city lamps.
St. Joseph, Mo.....	4.00	12½ p. ct. off on bills over $100 p. month.
St. Albans, Vt.....	5.00	10 p. c. off prompt pay, and in addition 5 p. c. off bills from $50 to $100 per month; 10 per. ct. off bills over $100.
Sandusky, Ohio.	3.00	
Saratoga, N. Y.....	5.00	20 p. c. off prompt pay, Nov. 1st to May 1st. 10 p. c. rest of year.
San Antonio, Texas....	7.00	10 per ct off from 10 to 20,000 per month 20 p ct off from 20,000 and upwards.
St. Charles, Mo.....	4.50	
Sidney, Ohio.....	3.25	
Steubenville, Ohio.....	2.50	
Sherman, Texas.....	5.00	5, 10, 15 and 20 p. c. off, according to quantity.
Salem, Oregon.....	7.00	October last reduced from $8.
Salem, Ohio.....	2.75	Meter rent 12½ cts if 300 feet is not used monthly
Sedalia, Mo.....	3.50	
Sharon, Pa.....	3.15	5 per ct off on less than 5000 feet per month. 10 p ct from 5 to 15 M. 15 p ct from 15 to 20 M. 20 per ct over 40 M.
Shreveport, La.....	5.00	
Shelbyville, Ind.....	2.00	Wren's process; $10 for 80 candle gas.
Shenandoah, Pa.....	10·00	70 candle. Patton's process.
Shamokin. Pa.....	10.00	70 candle. Patton s process.
Sunbury, Pa.....	10.00	70 candle. Patton's process.
Tiffin, Ohio.....	3.00	
Titusville, Pa.....	3.00	
Tidioute, Pa.....	2.00	Wren's process.
Vicksburgh, Miss.....	4.50	
Wilkesbarre, Pa.....	3.50	10 p. c. off prompt pay.
Worcester, Mass.....	3.00	5 p. c. off on $500, and 10 p. c. off on $1000 in six months.
Westfield, N. Y.....	4.00	10 p. c. off prompt pay.
Washington, D. C.....	2.25	
Watertown, N. Y.....	4.50	10 p. c. off prompt pay.
Wheeling, West Va....	2.25	10 p ct off prompt pay.
Washington, Pa.....	2.50	
Woburn, Mass.....	3.00	
Waterbury, Conn.....	3.50	5 p c off on biils of $50 10 p c off on bills of $100. 5 p c added if not paid by 10th.
York, Pa.....	3.00	Meter rent 12½ cents.
Youngstown, Ohio.....	2.50	10 p. c. off on bills of $50 per month.
Waterbury, Conn.....	3.00	5 p c off on bills of $50, 10 p c off on bills of $100; 10 p c added if not paid by 10th.
Washington, C H., O.	1.20	Wren's process; $6 for 80 candle gas.
Wilmington, Del.....	2.50	Street lamps 3,650 hrs per year, $31.50 per lamp.
Zanesville, Ohio.....	2.70	10 p. c. off on bills of $25 per month; city lamps $23.

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

August 16, 1876.

☞ All communications will receive particular attention

Gas. Co.'s of N. Y. City.

	Capital.	Par.	Bid.	Asked.
Harlem	$1,850,000	50	115	120
Manhattan	4,000,000	50	240	...
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000,000	..	102	—
" Bonds.	500,000	1000	104	—
Mutual	5,000,000	100	109	111½
" Bonds, gold.	900,000	1000	105	—
New York	4,000,000	100	135	140
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	10	...
" Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	125	135
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	99	100
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Richmond Co., S. I.	300,000	...	100	105
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri.	600,000	50	—	100
Stillwater, Minn.	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y.	15,000	100	110	115
Troy, Citizens	600,000	100	—	100
Central, Westchester	466,000	50	100	105

Gas Co.'s of Brooklyn.

Brooklyn	2,000,000	25	190	195
Citizens	1,200,000	20	85	87
" Scrip	320,000	1000	95	100
Peoples	1,000,000	10	50	55
" Bonds	$ 325,000	...	—	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	70	78
Nassau	1,000,000	25	75	80
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	125	130
" Scrip		...	100	103

Out of Town Gas Companies.

Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	—	90
Baltimore, Md.	2,000,000	100	150	170
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	90	95
" " Ctfs.	53,000	—	—	—
" " Bds.	124,000	—	—	—
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	152	—
Hempstead, L.	25,000	100	...	—
Jersey City	386,000	20	160	—

The Williamsburgh Gas Company have declared their regular quarterly dividend of 3%, payable on demand. The interest on the scrip of the same company was paid the 24th inst.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

July 17, 1876.

DELIVERED IN NEW YORK.

English Cannel.

Ince Hall	$17 00	@	18 00
Kirkless Hall	16 50	@	17 00

English Caking Coals.

Newcastle Gas	$5 50	@	00 00
Liverpool caking	11 50	@	12 00

British Province Coals.

Pictou	2 00
Block House—At Mines, $1.87, Gold	2 00
Caledonia—At Mines, $1.50, Gold	0 00
Little Glace Bay—At Mines, $1.75, Gold	0 00
Lingan—At Mines, $1.75, Gold	0 00
Sydney—Old Mine	3 00
" Reserve, $1.75, GoldMine	0 00
" International	— —

Duty, 75 cents per ton, gold. Freight to New York $2 00 currency. Cost of above coals delivered in New York, $4 75 @ $5 00, currency.)

Pennsylvania Coals.

Penn Gas Coal—At Amooy	$5 60	@	0 00
Westmoreland—At Amboy	5 60	@	0 00
Shafton	5 60	@	0 00
(In New York, the above coals $6 00)			
Youghiogheny	6 00	@	0 00
Waverly	6 00	@	0 00

West Virginia Coals.

MurphyRun	6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —

American Cannel Coals.

Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25

Asphalts.

Albertite of New Brunswick	$21 00	@	— 00
Trinidad Bitumen	— —	@	14 00

The Penn Gas Coal Company have contracted with the PittsburghGas-Light Co. for their entire supply for th ensuing year from their Youghiogheny mines.

Within the last week contracts have been made by some of the companies in New York for about 200,000 tons of Penn Westmoreland, Waverly, Youghiogheny, and the West Virginia caking coals—at $6 00 per ton a reduction of 50 cents from last years' prices.

WANTED TO LEASE.

A GAS WORKS OF ANY CAPACITY, FROM 1,000 TO 10,000 feet Coal Gas per day, by a practical gas maker' Parties having such to lease will please send particulars to

E. W. GUILD,

4?2-2t 13 Bassett St., Providence, R. I.

Wanted to Purchase for Cash.

A GAS WORKS IN A TOWN OF FROM TEN TO FIFTEEN thousand inhabitants. Address Hamilton Gas-Light and Coke Co., Hamilton, Ohio. 412 t

TO GAS-LIGHT COMPANIES.

WANTED—A SITUATION IN A GAS WORKS. THE undersigded (a young man) who has had seven years experience, connected with the operations of gas works' wishes to engage himself as Superintendent of a works' where the make is 5,000 to 50,000 per diem, or will accept a position in any department connected with operations of works. Address Superintendent, care of M. Coombs, Jr., Engineer Gas Co., Youngstown, Ohio· 412-uni

FOR SALE,

A HALF INTEREST IN A SMALL GAS WORKS WILL be sold. or leased to a practical gas man. Two thousand feet of natural gas per day. Address

J. SHACKELTON,

405-tf Westfield, N. Y.

NATIONAL FOUNDRY

AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, an all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.

☞ SEND FOR CIRCULAR AND PRICE LIST. 41

S. DECATUR SMITH,

CAST IRON GAS and WATER PIPE,

Foundry, Cor. of York and Moyer Streets,

PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS. 93

GAS COMPANIES, CITY GOVERNMENTS. MEN OF SCIENCE,

AND THOSE INTERESTED IN

Lighting Streets, Hotels, Churches, Bridges, Parks, Public Buildings, Etc.,

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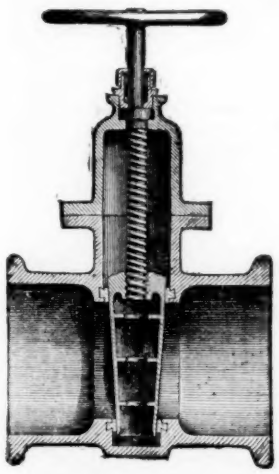

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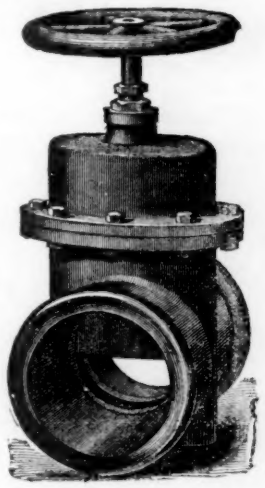

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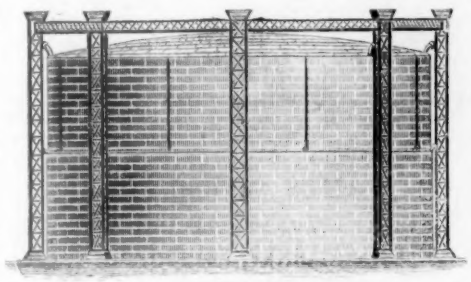

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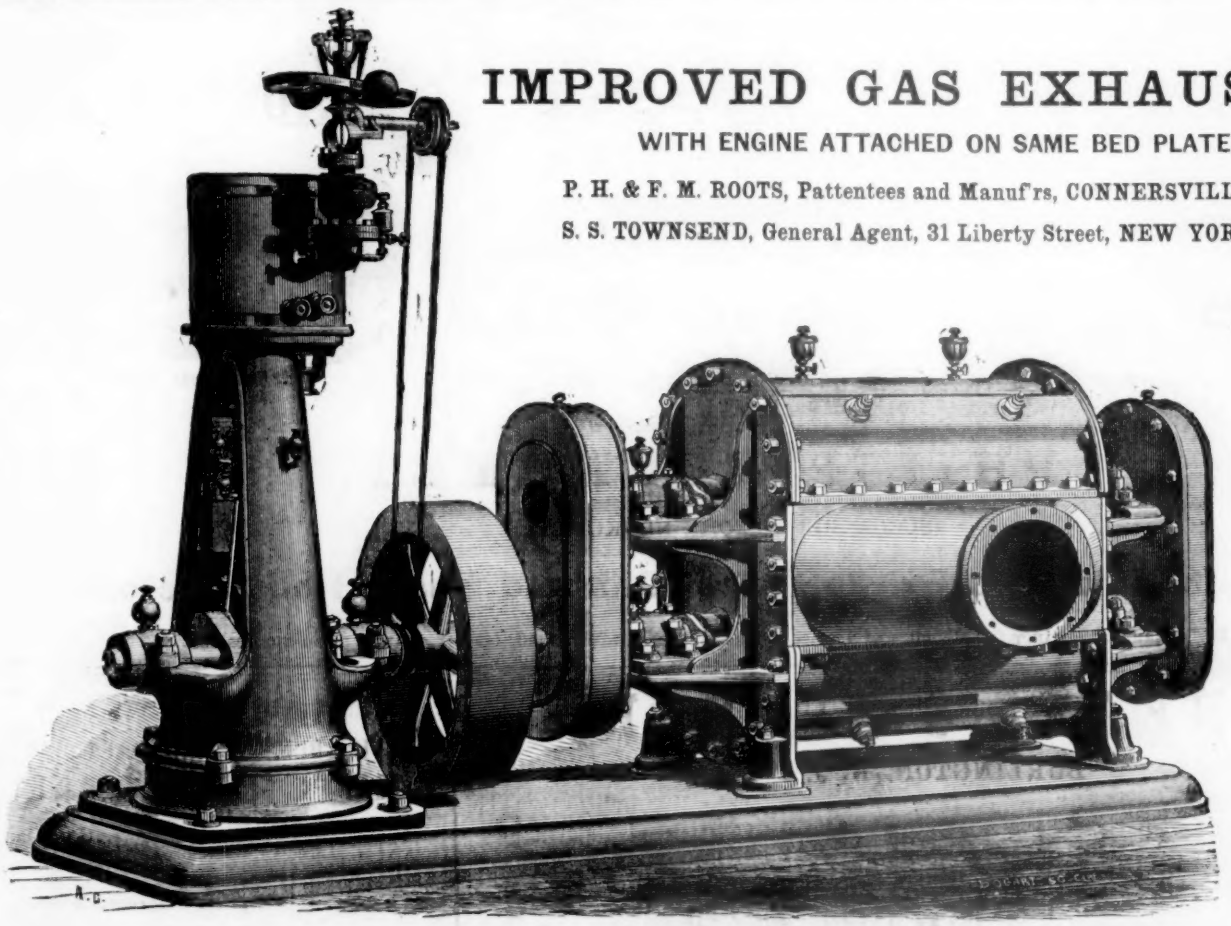

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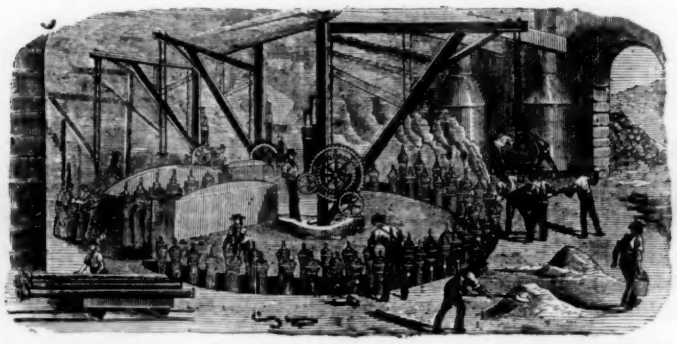

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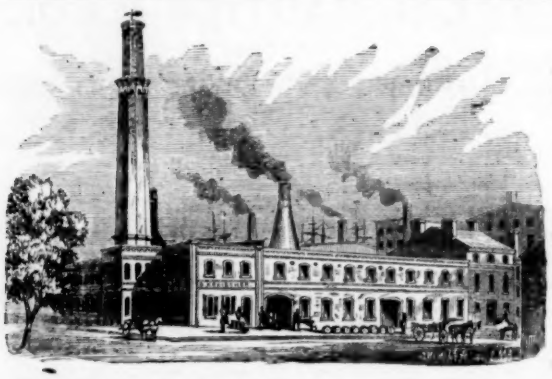

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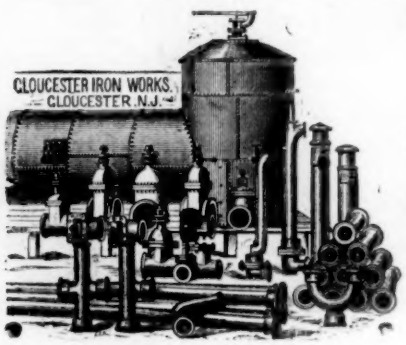

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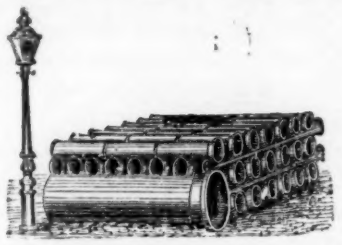

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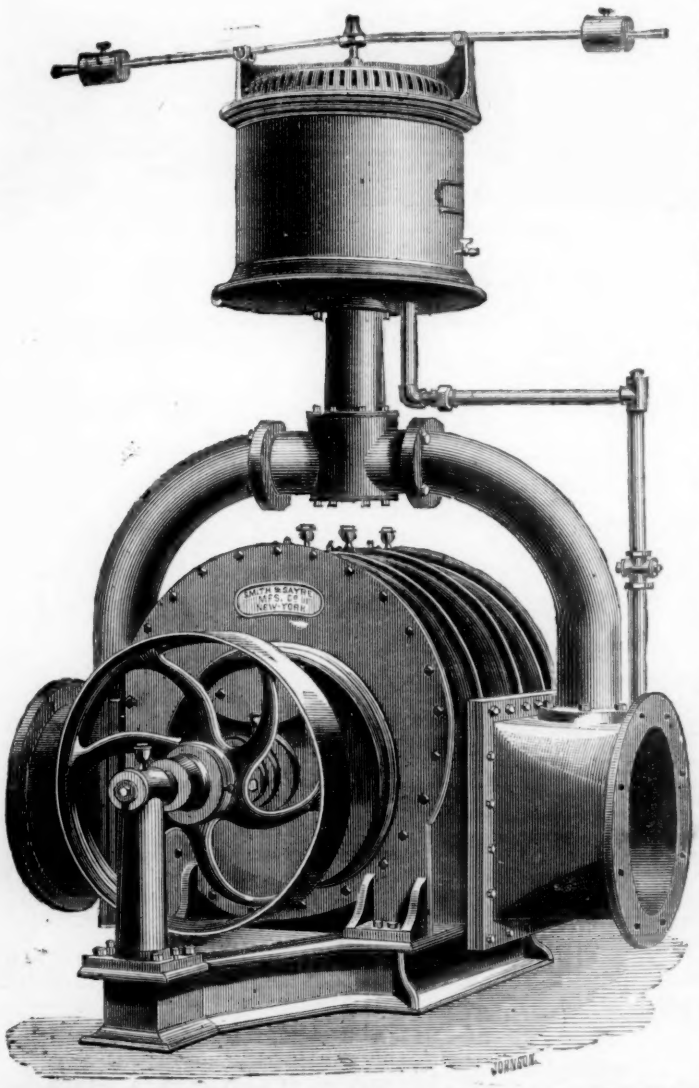

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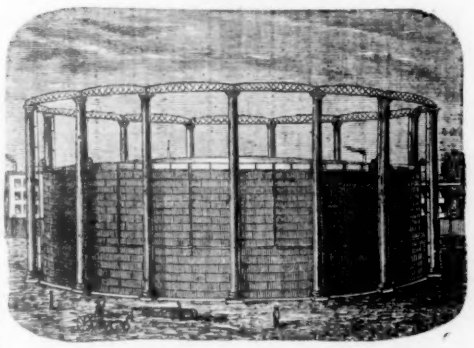

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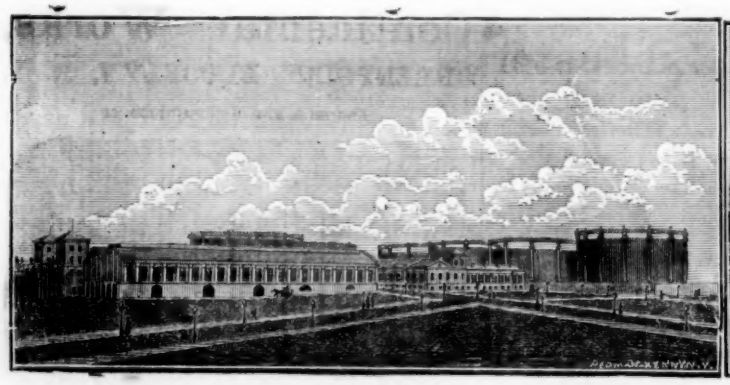

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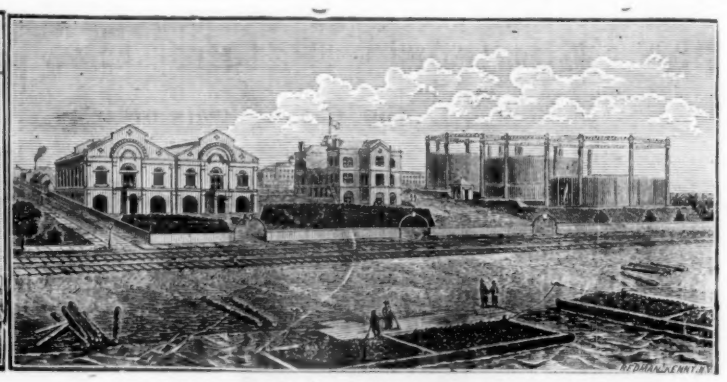

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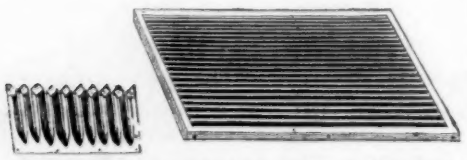

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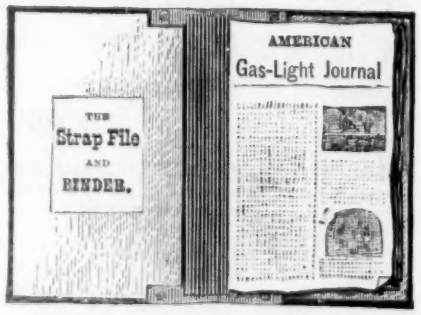

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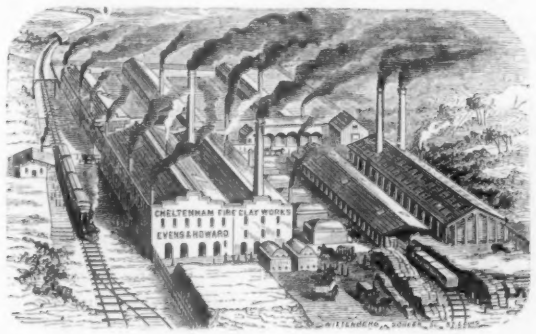

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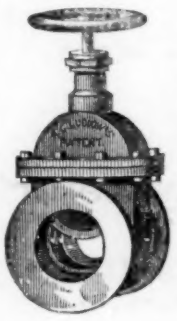

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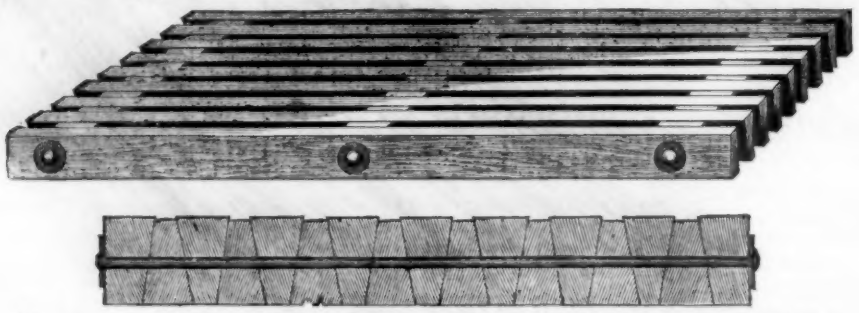

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